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Index to Advertisers—Page xl.

Electrical Retailing

A cleaning-up effort

THERE was a time when the sale of electrical appliances was considered a somewhat specialised business and consequently it was largely in the hands of those who installed electricity. As the electrical industry progressed through the combined efforts of supply authorities, manufacturers and contractors, electrical appliances became more familiar and appeared to be a profitable side line. Thus many non-specialists began to sell them.

Some of the less reputable electrical dealers were little concerned with the suitability or safety of the equipment which they disposed of and were able to charge prices which made the cost of sound and reliable appliances look exorbitant. Others with more conscience (shall we say?) managed to obtain good equipment which they proceeded to sell at prices approximating to those of the doubtful apparatus. As the legitimate discounts are sufficient merely to provide a reasonable margin to the retailer who has premises and a reputation to maintain, the result of this was too often the issuance of a receiving order.

The hands of the specialist electrical retailer were further weakened by the competition of electricity supply authorities, who increasingly instituted hire and hire-purchase schemes for the larger and more profitable equipment and sometimes even competed in the sale of the smaller appliances.

Fair Trading

In these circumstances it was obvious that action had to be taken to prevent electrical retailing from the fate which has overtaken the radio trader, and the Fair Trading Council was formed to bring about some sort of order. Its aim was to unite the different sections of the electrical industry in such a way that manufacturers and wholesalers would grant discounts only to bona-fide electrical retailers, who were defined in the Policy drawn up by the Council. The retailers were represented on the Council by the National Electrical Contractors' Trading Association, the trading organisation of the E.C.A., the only existing body which could claim to be representative.

Trouble then arose, not from unorganised retailers whose conduct the Policy sought to improve, but from the Ironmongers' Federated Association which maintained that it had staked a claim in the electrical field in the earliest days of the industry. It formed an Electrical Section and demanded separate representation upon the Fair Trading Council. The Council pointed out that retailing interests were already adequately and ably represented by the N.E.C.T.A. members, and in our issue of December 13th, 1935, we agreed with this view, saying :—

> "If they (the ironmongers) really wish to take a hand in cleaning up the electrical trade, they will find it advisable to co-operate with those who are thoroughly conversant with the situation and will welcome assistance. But to add another section to the industry will merely have the effect of further dissipating the energies which should be concentrated on the difficult problems which the Fair Trading Council has in hand."

We considered that the "electrical" ironmongers could achieve all that they desired by becoming members of N.E.C.T.A., if they were qualified. In spite of its title, the membership of the Association is open to bona-fide retailers whether contractors or not.

A New Association

In an effort to make things easier for the non-contracting retailer the E.C.A. decided to form another body, membership of which would not entail such high qualifications or fees as those required by N.E.C.T.A. The co-operation of the Electrical Section of the I.F.A. was invited, but the ironmongers were set upon separate representation and in reply suggested the appointment of a co-ordinating committee jointly by the two Associations. The N.E.C.T.A. could not see that any useful purpose would be served by such a committee and said so, whereupon the I.F.A. advised its members to have nothing to do with the new Association—the National Association of Electrical Retailers.

The N.E.C.T.A. has proceeded slowly with the new organisation, hoping that the ironmongers would after all take a hand, and the N.A.E.R. has not been registered as a limited company so that the door is left open. Membership is restricted to retailers who have suitable premises for the display and sale of electrical goods, are financially sound, and stock a minimum quantity of appliances, varying acording to the nature of the district.

We understand it is proposed in the near future to start a campaign to secure members and that 10,000 retailers are to be approached. This seems to be an extraordinarily large number and we

hope that a careful selection will be made. But after all, even if some of the people approached are not at present wholly desirable, they may be improved by organisation, which, of course, is the principal aim. The fewer the number outside the Association the better it will be for the trade as a whole.

The progress of the scheme, which has the sympathy of the large stores, will be followed with interest by the rest of the electrical industry.

Lightening Ship

How far is mere historical sentiment responsible for the retention in a college syllabus of items that are clearly unlikely to be of use to students in later life? We mean "use" in its broadest sense, mindful that some subjects which may appear to have little bearing on modern practice are worth including, either because they provide the best examples of the working out of fundamental principles or because they develop the kind of engineering imagination that increases the power of initiative; also that "modern practice" itself very quickly becomes outmoded. Nevertheless, the changed conditions due to the vast influx of knowledge from physics into engineering of recent years would of itself justify the contention of Professor R. V. Southwell in his presidential address to the Engineering Section of the British Association that the time is ripe for a general stocktaking. There will, we believe, be wide support for his view that the curriculum should be lightened and not further loaded, since the acquisition of knowledge beyond the power of students of good abilities to assimilate it is not only waste of time but may actually endanger the power of the engineer to apply what he knows. After all, passing examinations provides only an indication that the embryo engineer has got together enough intellectual raw material for his work. The time is ripe and Dr. A. P. M. Fleming is President-elect of the I.E.E.

IN THIS ISSUE

	Page
Articles:	
Laundry Processes ..	*271*
The Electric Vehicle Association	*273*
Driving Earth Electrodes	*274*
Film Speech Reproduction	*277*
Lift Installations ..	*278*
Electric Ovens for Fertilisers	*279*
News:	
British Association Meeting	*281*
Overseas Electrical Trade	*285*
Lamp Propaganda ..	*286*
Personal and Social ..	*296*

Earth Electrodes

IT has commonly been held in this country that there is rarely any advantage in going down more than 8 ft. or so into the ground in order to obtain a low-resistance earth. Recent developments in the United States, however, show that more often than is usually realised a longer rod gives considerably better results than several shorter ones connected in parallel. This is borne out by the results of the work described by Mr. H. G. Taylor in this issue, in which, for the first time in Britain, as far as we are aware, mechanical methods have been successfully applied to the driving of electrodes on a commercial scale. Moreover, in addition to the saving in the cost of excavation necessary with the buried electrode, the use of an electric or pneumatic hammer has the advantage of giving a better contact between electrode and soil. Present practice here needs reconsideration.

Encouraging Better Lighting

LIGHTING must still be regarded as the application which most frequently introduces electricity to potential consumers, and the better the lighting the better the chances are that the user will look about for other ways in which electricity may be employed with equal success. At the moment, probably not one house in fifty has adequate lighting. With the attractive two-part tariffs now available the cost of remedying this deficiency and using lamps of correct wattages is negligible. In any case, it is a small price to pay to safeguard eyesight and the resulting general health of the household. Details of lamp manufacturers' plans for the coming winter, published on another page, indicate that they, at any rate, are alive to the position and appreciate the potentialities of the market.

The Radio Exhibition

THE opening of the 1938 "Radiolympia" on Wednesday marked the beginning of the new radio season, for, despite efforts on the part of certain manufacturers to level out the public demand over the whole year, the radio trade is still to a large extent seasonal. For the past few years radio receiver design has appeared to have reached almost its limit, and such improvements as have been incorporated have been in the nature of detail refinements. This year, however, an entirely new feature has been included by most manufacturers, namely, automatic tuning. A tour round "Radiolympia" reveals a multiplicity of receivers fitted with rows of press-buttons, levers, or automatic dials, enabling a number of pre-selected stations to be tuned in accurately in a moment by the absolute novice. Television also occupies a large part in the displays. With receivers priced in the region of £30, and with no prospect of further reduction in price for some time to come, manufacturers feel justified in expecting that at last there will be appreciable sales of television sets in the Alexandra Palace service area. General features of the exhibition were described last week, and next week a more detailed review will be published.

French Supply Figures

TRENDS in electricity supply in France, as shown elsewhere in this issue, follow very much the lines of development in Britain. Thus, for the five years ended December 31, 1936, the average amount of coal burned per kWh fell by 13.4 per cent. to 1.61 lb. The reduction was greater here (17.4 per cent.) and the final result better (1.47 lb.), but as a regional average the record of 1.27 lb. put up by the Paris regional district claims precedence. No particulars of calorific value are available, but, as lignite has been excluded, the figures would be roughly comparable. As regards distribution, a.c. at voltages between 150 and 230 is gaining ground, both absolutely and relatively, d.c. being stationary. Networks distributing from 50 to 100 million kWh per annum are growing in number, but considerably fewer sell less than 10 million, and these as a group dispose of 50 per cent. more than they did two years before. The population without access to electricity supply has been halved within three years. A notable difference between electrical conditions in the two countries is that the consumption per head dropped in the depression years in France, despite the large proportion derived from water power, and it was not until 1936 that the previous highest level, attained in 1930, was exceeded.

Lighting Survey

OUR next week's issue will contain a survey of the present position and future possibilities of electric lighting. Among the subjects to be dealt with are the value of the lighting load, legislation in regard to factory lighting, floodlighting, the use of light for decoration and also for advertising, recent lamp and lantern improvements, and various problems connected with public lighting.

Laundry Processes

Modern methods of handling a large volume of work

THE recently extended Liverpool laundry of the United Co-operative Laundries Association, Ltd., is said to be the largest in this country. At any rate, with its laundry building proper measuring approximately 600 ft. by 200 ft. on a 5-acre site, and its output of about 43,000 bundles of washing per week, representing a turnover of about £4,500, it has the largest laundry electrical installation that we know of. The total h.p. of motors installed is about 1,100, and the weekly consumption of electricity is about 18,000 kWh. About 13 miles of cables, supplied by W. T. Henley's Telegraph Works Co., Ltd., have been used in the installation.

The huge volume of work referred to is collected from the customers by the organisation's fleet of motor and horse vans and delivered, *via* an unloading room at one end of the building, through hatchways and stacked in batches of about 1,500 to 2,000 bundles each.

Each batch is treated separately right through the laundry processes. The bundles are first divided out among 84 marking machines (illus. p. 280) by which every garment or article has the customer's identification number sewn on to it. The required number is first set up on an adjustable number plate with large characters deeply cut in metal, and by means of a cantilever arrangement like those employed on engraving machines the character is reproduced on the garment. Each Tillett's machine is driven by a ¼-h.p. motor.

The marking machines are arranged in lines of twelve each, and along most of the lines is a conveyor which delivers the marked garments, *via* a short incline conveyor, to a roundabout conveyor from which girls sort out the articles into various classes. A 2-h.p. s.c. geared motor unit with push-button contactor control chain-drives each line conveyor and its short incline belt. There are two

One of the large drying rooms showing extract fan motor at rear

long belts in the roundabouts, with a short "under and over" incline at each end, and at either end there is a 2-h.p. similar drive for one long belt and one interconnector.

The classified work is first taken in trolleys to the washing machines—horizontal cylindrical equipments with Monel inner containers and outer shells. Each revolving inner container is divided into four sections lengthwise and each section is sub-divided into three sections, so that there are twelve compartments in all. A surprise was the low speed of the container—about 16 r.p.m. with two reversals per minute. The power transmission for this is *via* a high-ratio reducing gear from a 7½-h.p. s.r. motor which is reversed automatically by Igranic contactor gear with a motor-driven drum selector switch. There are various electrical interlocks on the washing machines. For instance, opening one of the outer doors lifts a switch on a roller and thereby shuts down the motor. But the motor can be inched with the doors open, so that the inner cylinder doors and the outer container doors

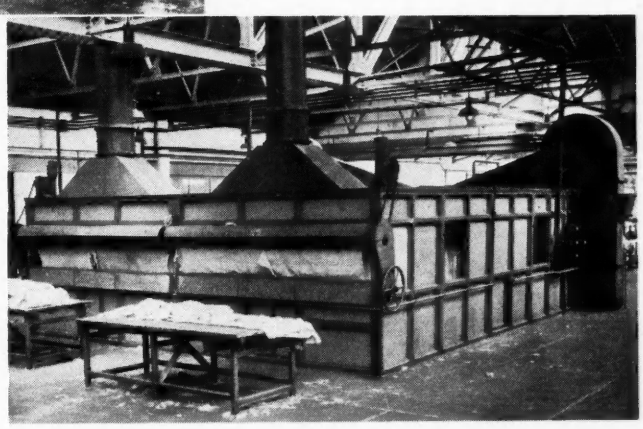
Roundabout classification conveyor

can be registered. Hand turning gear is also interlocked, so that when this is in operation the machine cannot be served at all electrically, not even by the inching button. Each large washing machine measures 54 in. in diameter and 120 in. long and it will wash at one time the equivalent of about 720 sheets or 1,200 shirts. The washing period is about one hour, during which there are seven changes of water (eight waters in all), while all the processes such as starching and blueing are done in the one machine.

The "wash" is ready for drying as soon as it leaves the washing machine, and the first drying process is hydro extraction. Each of the twenty or so extractors we saw is of the high-speed vertical-spindle type with a perforated revolving inner container (basket) which holds about one-third the capacity of a large washing machine. The drive is a 10-h.p. intermittently rated motor, for while the required starting torque for

Group of vertical-spindle, horizontal drive hydro-extractors

every run is 10 h.p. the running torque needed is only 3 h.p. The running period for the motor is set up on a time-switch equipment in which is embodied the push-button switch for the motor. When the motor has, say, only two minutes to run the clockwork automatically opens the starter circuit and

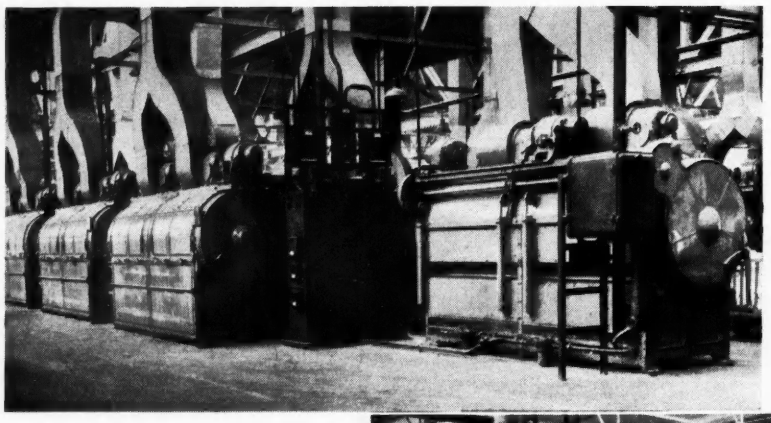


operates a brake on the machine. The lid of the machine cannot be opened until the basket is at rest. The basket and motor speeds are 960 r.p.m. and 1,440 r.p.m., respectively, and transmission is by V belt.

Final drying is effected in special drying "rooms" in the case of woollens and blankets and in dry-room tumblers for such articles as towels and sheets. A "room" measures, say, 11 ft. by 30 ft. and is "filled" by a conveyor on to which the articles are hung by gravity-pull catches. The mere 1-h.p. conveyor motor on such a large equipment is incongruous from one aspect, but the conveyor moves very slowly and there is a very wide speed reduction, firstly through incorporated gearing and then *via* chain transmission. A 7½-h.p.

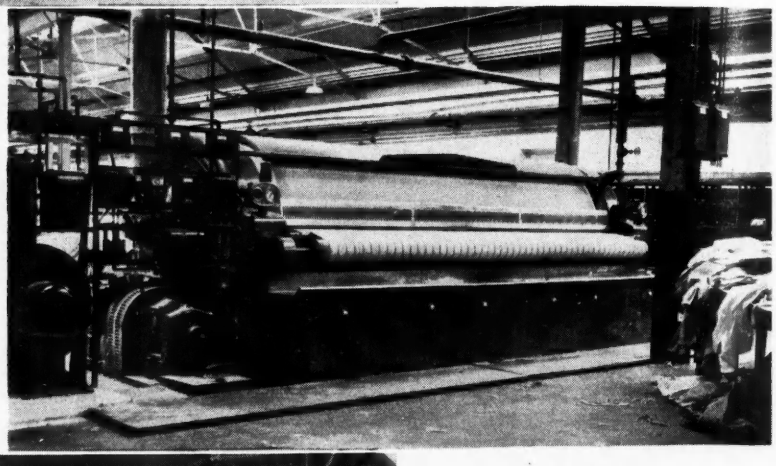
motor-driven fan on the roof sucks air through a steam-heated radiator in the base of the machine and dissipates the hot air into the "room" through louvres in the floor. There are a ½-h.p. exhaust fan near the front-top of the machine to protect the operatives from heat at the open door and a ¼-h.p. de-linting motor which propels brushes through the air passages to keep them clear of fluff.

Each of the horizontal cylindrical drying tumblers has a perforated inner container which is driven by a 5-h.p. motor with six reverses per minute. The reversing control equipment is similar to that employed for the washing machines. Underneath the inner drum is a steam radiator through which air is drawn by two fans on top of the machine, so that the articles are dried as they are tumbled about in a stream of hot air. Both the exhaust fans are driven by the same 10-h.p. motor.



Some of the dry-room tumblers

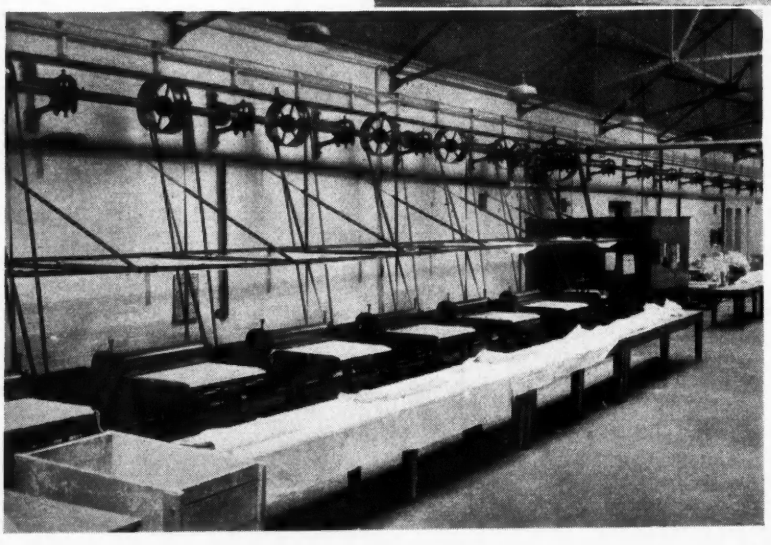
Ironing is the next major process; for this there are several kinds of equipment all with much the same operating principle. In a 54-in. diameter single-roll ironing machine the processing is effected by the polished upper surface of a semi-cylindrical steam-heated steel bed which is hydraulically held upwards against the central roller that carries the work round. The roller is perforated and covered with three layers of soft woollen blanket, so that the moisture from the garments is drawn into the centre and exhausted by fans—one at each end of the machine. The roller is driven by a 13-h.p. squirrel-cage motor through reducing gear, and between the gear and the motor there is a coupling of the fluid flywheel type by means of which an extremely flexible speed regulation of the central roller is obtained.



Single-roll ironing machine showing flywheel-coupling drive

A little motor pump on the driving motor bed-plate enables more or less oil to be pumped into the coupling at will. By a reversing switch at the front of the ironing machine the oil-pump motor is operated with an eye on an adjacent tachometer which shows the speed of work in feet per minute. Finger guards immediately in front of the roller operate a stop switch at little more than a mere touch, and this switch both throws the motor off circuit and applies an electro-magnetic brake to the machine. A dual-roll ironer has a 6-h.p. s.r. motor drive with a rheostat speed controller, and eight-roll machines have drives exactly similar to those of the single-roll equipment, except that the motor is of 14 h.p.

The only group drive we saw in the laundry proper is for a line of seven collar-ironing machines. A table carrying the work is pushed to and fro under the heated roll of each machine. The driving unit for the group is a 25-h.p. motor at floor level which transmits *via* belt to an overhead shaft from which there are "drop" belts to the machines in the line. A ½-h.p. motor serves each of the collar-finishing machines, which curl the collar to the shape of the neck. All told there is about 200 h.p. of motors employed in the ironing section. There is a battery of 198 garment presses all operated by compressed air supplied by two 40-h.p. motor-driven air compressors.



Group driven collar-ironing machines

The finished articles are taken immediately to the packing room where they are first sorted into letter classifications and then into racks each with a customer's number. Then the lots are parcelled ready for despatch. While sorting for one batch is going on at one side of the room a previously finished batch is being parcelled at the other side.

To revert to the first process, as soon as the articles of each customer are marked and checked the customer's book is sent to the accounting office, and the made-up book and laundry list await the finished articles in the customer's rack in the packing room. In the interim the list has been dealt with by electrically driven accounting machines. The "punching" system is employed and we should imagine it is almost foolproof. "Fixtures" such as the date and journey number are punched in bulk on a motor-driven machine while the customer's numbers and charges are punched on hand machines. Machines which sort the punched cards into number order and others which tabulate them are also motor driven. A batch takes roughly two hours to go through all the processes from marking to packing.

The large demand for process steam is met by four 30-ft. by 9-ft. 6-in. Lancashire boilers with a 7½-h.p. group drive employing V-belts for the mechanical stokers. A 30-h.p. motor-driven induced draught fan at the chimney base is common

The Electric Vehicle Association

Its aims and activities

By Colonel G. D. Ozanne, M.C., M.I.E.E.

Col. Ozanne

IN the leading article in this journal on June 10th last it is shown that the electric vehicle is receiving more and more attention both from electrical interests and also from those who desire to replace horse transport by something equally suitable and economical. It may, therefore, interest readers if I set out some particulars of the Electric Vehicle Association of Great Britain, its aims and activities.

The history of the Association dates from 1913, when the Electric Vehicle Committee of Great Britain was formed under the auspices of the I.M.E.A. This Committee, owing to lack of support, ceased to be a really active body about 1928, but was revived at the instance of the British Electrical Development Association in 1934, when it was formed into a company limited by guarantee. Its total assets were a small capital sum inherited from the old Committee and it had no income, being dependent on E.D.A. for office accommodation and secretarial work.

Experience quickly showed that some annual income was necessary not only to enable the Committee to increase its activities, but also to give members a keener interest in their Association. Earlier this year the Committee was reorganised and new articles of association were adopted providing a scale of subscriptions for membership. The name was also altered to the Electric Vehicle Association of Great Britain, Ltd., this being considered more appropriate. Membership is open to manufacturers of vehicles, batteries and accessories, and it has also representative members of B.E.A.M.A., E.D.A. and the E.C.A.

The Association is confident that the near future will show a rapid increase in the number of electric vehicles in service, and it is its aim to bring to the notice of interested parties the value and economy of this type of transport.

The main object of the Association is to increase the number of electric vehicles in service and to protect the interests of its members. The following is a brief summary of its policy in order to attain this object.

In regard to research, the Association considers that this must remain the responsibility of individual manufacturer members. It can, however, deal with matters of general interest submitted to it by members, and collect all available information regarding the performance and design of electric vehicles in use by its members and others.

Towards Standardisation

The problem of standardisation is constantly under the consideration of the Association, and special efforts are being made at the present moment in connection with batteries, containers and charging equipment, and considerable success is being achieved. The Association also prepares standard forms of specification and tests for electric vehicles, and hopes in the near future to issue test certificates.

The Association also uses its influence to obtain from supply authorities uniform rates and conditions for battery charging. There is no doubt that the electric vehicle represents a very attractive load to the supply undertaking. Each vehicle will consume more than 5,000 kWh per annum, and for the most part this is an off-peak supply. Supply authorities must, however, bear in mind that it may be essential to give a boost charge during the middle of the day, and it is hoped that they will make provision accordingly.

This raises the possibility of standardisation of batteries and battery containers which would undoubtedly do much to increase the use of the electric vehicle, especially if the supply authorities and the battery manufacturers could co-operate to make fully charged batteries available to replace those which have been discharged. The scheme is analogous to the old system of obtaining relief post horses in the days of coaches. The problem is mainly one of finance and could be solved if a scheme could be formulated whereby the user of an electric vehicle could obtain on hire a fully charged battery at an inclusive price as often as he might find it necessary. There is then no doubt, in my opinion, that there would be an immediate increase in the number of vehicles in use. This scheme would also benefit the supply authorities, who could charge the batteries when most convenient.

In regard to publicity, the Association confines its efforts to the potential user by the promotion and control of publicity campaigns in various parts of the country, by organising collective exhibits at certain exhibitions and shows, and by preparing publicity literature and posters for its members.

Publicity Campaign

In this connection there is at the present moment in preparation in collaboration with the supply authorities and the manufacturers a large publicity campaign in the North West England and North Wales Area which will commence in the autumn and extend over a year. The members of the Association have also agreed to patronise only those exhibitions and shows which are approved by the Association.

Finally, the Association maintains contact with Government Departments and other large organisations in order to protect the interests of its members and present their point of view. Mention must be made of the great encouragement and assistance which the Association has received from the British Electrical Development Association, and the Electric Vehicle Association is fortunate in having Mr. A. C. Cramb as its secretary. Much of the future of the electric vehicle lies, in my mind, in the hands of the supply authorities. Once they appreciate the value of the load and simplify the problems of refuelling and maintenance, then the future of the electric vehicle in this country is assured.

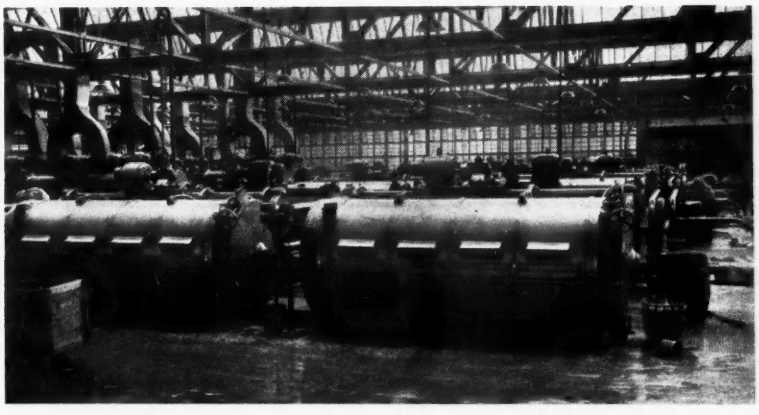
Laundry Processes *(Continued from previous page)*

to all the boilers. In the outhouses feed for the horses is dealt with by electrically driven equipment. A chaff cutter delivers the treated fodder to a belt conveyor which carries it through containers served by feeder conveyors for oats and bran mixing and from there on to a bag filler.

Most of the motors we saw are products of Brook Motors, Ltd., and Lancashire Dynamo and Crypto, Ltd. There are about 600 lighting points in the laundry proper, averaging about 200 W per point.

Many of the 1,500 operatives take meals in the excellent dining rooms on the premises and in the kitchens we saw two 25-kW double-oven heavy-duty cookers and a 6-kW hotplate and cupboard. From the Liverpool electricity undertaking's sub-station on the laundry site is fed a set of isolator links at 400/230 V. This serves a combined three-phase and single-phase iron-clad distribution switchboard with a 1,250-A incoming, 600-A and 400-A three-phase power and 200-A and 100-A single-phase power and lighting feeder oil circuit-breakers. This switchboard is linked by a four-core armoured cable with a board in another switch room erected for a recent extension.

In parallel with the supply is a 360-kW "no-lag" motor which is employed running light purely for power factor correction. By the use of this equipment the power factor has been improved considerably—from 55 to 85 lagging. A "Keep-alite" emergency lighting system is installed. The main switchboards were supplied by the British Thomson-Houston Co., Ltd., and most of the distribution in the buildings is by M.E.M. iron-clad fuse boards and switch-fuses.



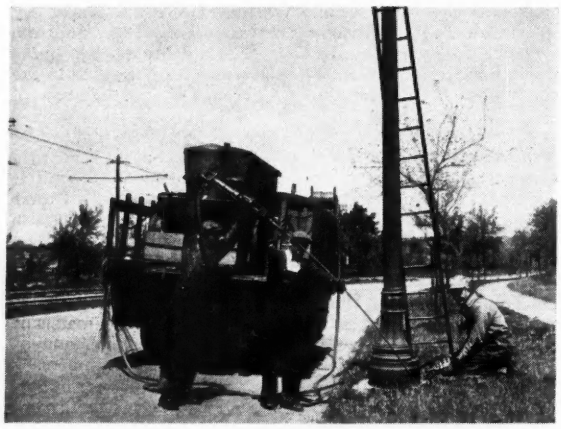
A group of washing machines

Driving Earth Electrodes

By H. G. Taylor, M.Sc.(Eng.), A.M.I.E.E., F.Inst.P.

Comparison is made of British and American practice and tests carried out by the Copper Development Association are described

SINCE the E.R.A. commenced its investigations on earthing in 1931 the use of driven rods and pipes for earth electrodes has become very popular in this country. Previously, the commonest form of electrode was the buried plate, but for a given resistance it is much more costly to install than the driven electrode. The pipes used have generally been 1 in. diameter mild-steel water tubes; for rods, ¾-in diameter mild-steel is common. These electrodes may be



Courtesy, Kansas City Light & Power Co.

Driving a small-diameter rod with a pneumatic hammer

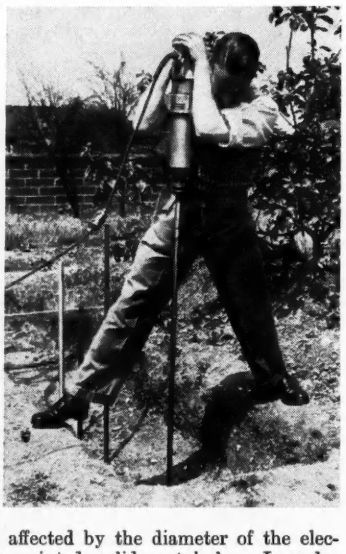
driven in almost all soils without bending or undue damage to the end.

In this development we have followed the practice in the U.S.A., where driven electrodes have been common for many years, but their ideas have not remained static and we can still learn much from American engineers. Three developments which have taken place in recent years and which have not been followed in this country are: (1) the use of electrodes of smaller diameter than ¾ in., *e.g.*, ½ in. or ⅝ in.; (2) the use of very long electrodes and coupled electrodes; and (3) the use of mechanical means for driving them.

The Copper Development Association, with the co-operation of the North Metropolitan Electric Power Supply Co., has carried out tests on these three features and the results fully justify the view that similar developments of technique and practice are desirable in this country.

Resistance of Soil to Driving

The resistance of soil to the driving of electrodes varies very considerably with the nature of the soil. For example, in boggy soil a 6 ft. by 1 in. diameter tube can be



Driving a ¾-in. Copperweld rod with a "Kango" electric hammer

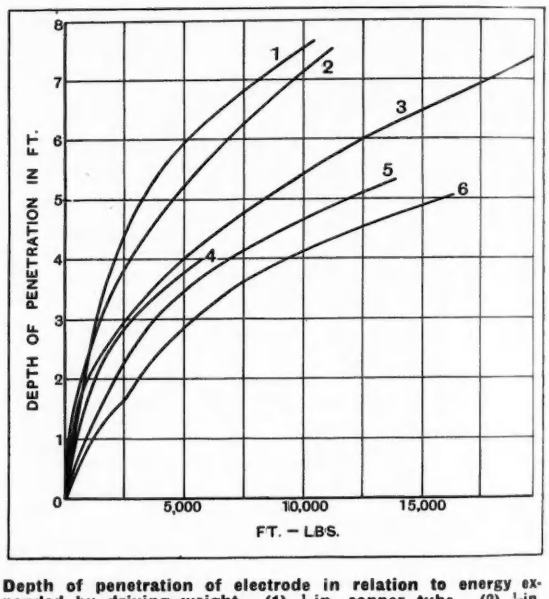
Courtesy, Mansions Motor Co.

inserted by hand, whereas in a dry clay soil such an electrode could not be inserted 6 in. without hammering. The presence of stones or flints also considerably impedes installation. The resistance is, in addition, affected by the diameter of the electrode, and whether it is pointed, solid or tubular. In order to examine the latter factors, and to find whether small diameter electrodes could be satisfactorily driven, tests have been made in which the number of foot-pounds for a given depth of driving were measured.

In order to make the results on various electrodes comparable a homogeneous soil was selected at Wood Green. The superficial layer of loam, about 18 in. deep, was first removed, and the electrodes installed in the London clay below. A length of conduit was secured to a builder's trestle, and the latter adjusted until it was vertically over the electrode, the end of which entered the conduit for a short distance. On the top of the electrode rested a steel "dolly," about 4 in. long, fitting loosely in the conduit. The driving weight was attached to a cord and could be lifted and dropped a measured distance on to the "dolly." After a given number of blows, the depth of installation was measured.

Rig up for driving tests

The smaller the diameter of the electrode the greater the depth of penetration for a given expenditure of energy. Thus



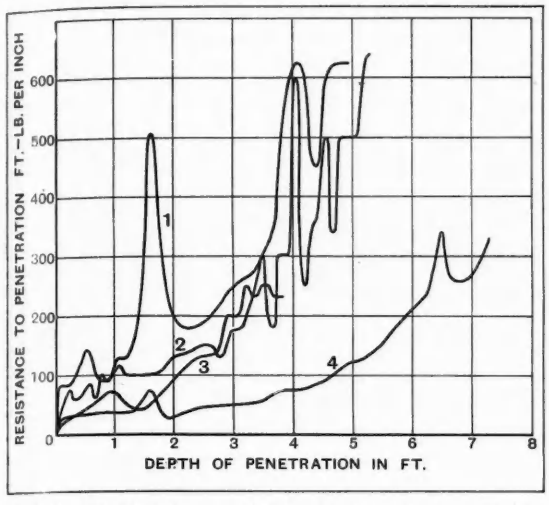
Depth of penetration of electrode in relation to energy expended by driving weight. (1) ½-in. copper tube. (2) ½-in. pointed Copperweld rod. (3) ¾-in. pointed Copperweld rod. (4) ¾-in. copper tube. (5) 1-in. copper tube. (6) 1-in. mild-steel tube

5,000 foot-pounds will drive a ½-in. copper tube 6 ft. into the ground whereas a 1-in. mild-steel tube can only be driven for slightly less than half this distance. (The m.-s. tube had an outside diameter of $1\frac{5}{16}$ in. and the copper tube one of 0.596 in.) The ½-in. Copperweld rod* appears to be slightly worse than the ½-in. copper tube but on the other hand, the ¾-in. Copperweld rod is slightly better than the ¾-in. copper tube, such small differences being due probably to soil variations on the site.

The shape of the curves is controlled by a number of factors, and doubtless these would have different effects in different soils. Clearly the resistance of the soil itself to displacement may increase with depth, quite apart from the possibility of encountering stones. Then the displacement of the soil from the tip of the electrode depends on the shape, and, with a tube, in the early stages the resistance is much less than in the

*Copperweld rods have a steel core covered with a copper sheath of substantial thickness, which is applied in the ingot stage and rolled down with the steel.

later stages when the soil forms a solid plug in the tube end. In addition, there is probably the most important factor (at least in clay soil) of the frictional resistance due to the pressure of the soil on the outside of the tube. Were the latter the



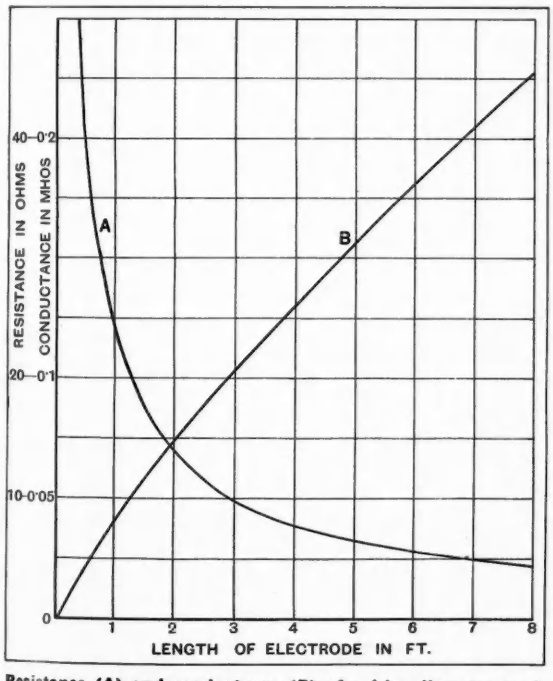
Variation of soil resistance with depth of penetration. (1) 1-in. mild-steel tube. (2) 1-in. copper tube. (3) ¾-in. copper tube. (4) ½-in. copper tube

only factor the curves would be parabolic with the depth of penetration proportional to the square of the energy expended, and the curves shown approximately conform to this law.

The resistance to penetration is not uniform. It increases with the depth but is very erratic in most cases, and in some cases the increased resistances were probably not due to stones but to hard layers of soil extending over a considerable area.

Method of Driving

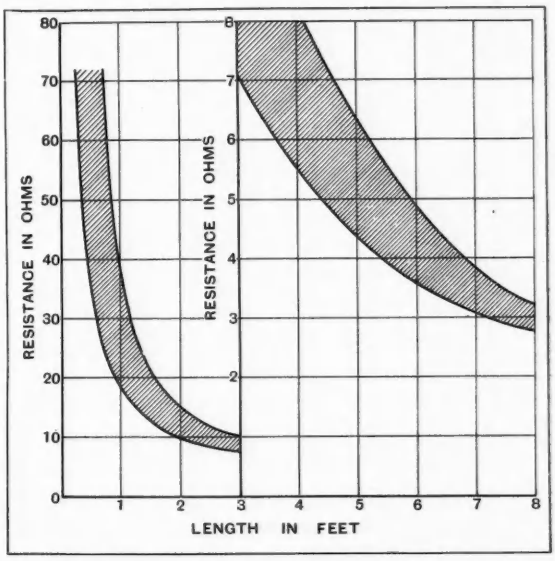
These tests show that considerably less effort is required to drive small-diameter electrodes, provided that they are not so small that they are bent during installation. Bending is more dependent, however, on the method of driving than on the soil resistance. If one attempts to drive an electrode into solid rock with heavy blows, the top of the electrode will quickly be deformed. If, however, light blows are used, no matter



Resistance (A) and conductance (B) of a ½-in. diameter earth electrode in soil having a resistivity of 1,000 ohm-cms.

for how long they are continued, the electrode will not be bent, though its upper end may be somewhat deformed in time. Consequently, for a given size of electrode, the higher the soil resistance, the less the strength of the blow which may be permitted. Similarly, the smaller the diameter the smaller the permissible blow in a given soil. Successful driving depends on the stresses induced by the blow being less than the elastic limit of the electrode.

The ideal way of driving an electrode is therefore, to use a very large number of light blows, and the simplest method of doing this is by means of a pneumatic or electric hammer. The former method has been used in the U.S.A. In many instances, however, an electric hammer may be a more convenient tool, particularly as it would have many other uses such as the cutting of chases in walls for buried conduit, the drilling of walls for wood plugs or the drilling of concrete for holding down bolts. The Mansions Motor Co., Ltd., was



Variation of resistance with length; results of tests on seven electrodes varying in diameter from ¼ in. to 1⅝ in. Clay soil. Curves show extreme limits of all results

therefore invited to co-operate in some tests using the "Kango" electric hammer, and, possibly for the first time in this country, a number of earth electrodes were driven into the ground by mechanical means.

The electric hammer was found to be very effective, and in every case the electrodes could be installed to their full length. The hammer has a consumption of 500 W, and, therefore, may be connected to any convenient lighting or power point; 1,400 blows per minute are delivered and very little assistance from the operator is required. The best rate of driving was 11.5 ft. per min., with a ½-in. copper rod in gravel and sand, and the lowest rate 1.4 ft. per min. with a ¾-in. copper tube in clay. A very convenient size of electrode—a 6 ft. by ⅜ in. diameter copper rod—was driven to a depth of 5ft. 6in. in 42 sec. in hard chalk, and three 8-ft. lengths of ½ in. Copperweld rod coupled together to form one 24-ft. rod, were installed in sandy gravel in a total driving time of 5 min. 46 sec.

This electrode admirably demonstrated the advantage in certain soils of driving to a considerable depth, since the earth resistance of the first 8ft. was 1,700 ohms, whereas when the second section was added, this value fell to 47 ohms. Obviously, between 8 ft. and 16 ft. occurred a low resistivity layer of soil which made the 16-ft. electrode of as much value as thirty-six 8 ft. rods connected together in parallel. It is not uncommon for the resistivity of soil to diminish as the depth increases, but such a large variation as this is exceptional. In the majority of soils 8-ft. electrodes would be long enough, but where the resistance is very high, it is better to increase the depth than the number of electrodes, in the hope of reaching a low resistivity layer.

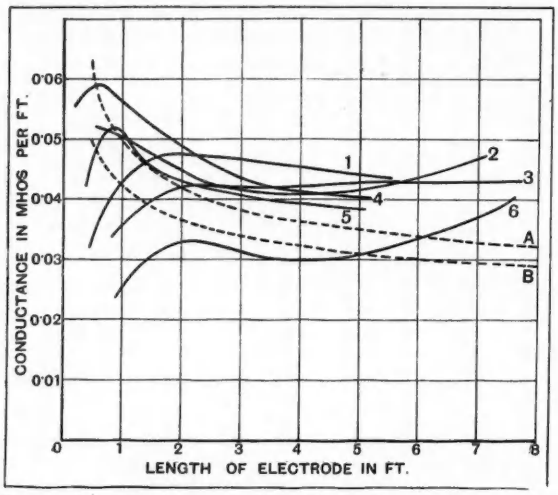
Detailed results of the driving tests are given in the table:

Electrode.			Driving Times.		
Material.	Diameter.	Length.	Clay.*	Hard Chalk.†	Sandy Gravel.‡
Copper rod	⅝in.	5ft. 6in.	—	42 sec.	1 min. 5 sec.
	½in.	9ft. 6in.	3 min. 27 sec.	—	—
	½in.	11ft. 6in.	—	—	1 min. 0 sec.
Copper-clad steel rod.	½in.	7ft. 6in.	2 min. 37 sec.	1 min. 47 sec.	—
	½in.	7ft. 0in.	—	2 min. 15 sec.	—
	½in.	7ft. 6in.	5 min. 26 sec.	—	—
	½in.	24ft. 0in.	—	—	5 min. 46 sec.
Copper tube	¾in.	7ft. 6in.	2 min. 50 sec.	1 min. 52 sec.	2 min. 56 sec.

* Very uniform London clay. †Very hard chalk, similar to limestone. ‡Tests made at a gravel pit; soil very patchy, with many stones.

These tests provide conclusive proof that the length of an earth electrode has much more influence on the electrical resistance than has the diameter. This applies even in homogeneous soils, but length is additionally advantageous where resistivity decreases with depth—as is usually the case—and where permanent moisture exists at some distance below the surface.

The shape of the resistance-depth curves often leads to the impression that there is little advantage in increasing the depth beyond a few feet, but this is generally an illusion, depending on the scale to which the results are plotted. A more useful curve is that of conductance against length, since the conductance is proportional to the current which flows under constant voltage, and it is the current which determines whether the circuit will be cleared by the fault. The resistance curve flattens out, but the conductance curve is practically a straight line, and indicates that the longer the electrode the better.



Change of conductance per ft. with length of electrode in ground (1) 1-in. mild-steel tube. (2) ¾-in. Copperweld rod. (3) ½-in. Copperweld rod. (4) 1-in. copper tube. (5) ¾-in. copper tube. (6) ½-in. copper tube. Curves A (1-in. rod) and B (½-in. rod) assume homogeneous soil having a resistivity of 1,000 ohm-cms.

The disadvantages of using electrodes exceeding 8 ft. are the difficulty of handling such lengths, the possible need for coupling lengths together, and the lack of suitable driving facilities. This must be compared with the greater ground space required by a number of electrodes in parallel, the need for additional clamps and cable to connect them, and the possibility of the superficial layer of soil being of high resistivity so that the upper parts of the electrodes may contribute little to the reduction of resistance, whereas at a depth greater than 8 ft. (say) the soil may be of uniformly low resistivity. The choice will depend entirely on circumstances. Thus in the case cited above, where the first 8 ft. had a resistance of 1,700 ohms, the expense of reducing the resistance by a few ohms by adding other electrodes in parallel would be prohibitive. On the other hand, if an 8 ft. electrode had a resistance of 20 ohms, and there was no reason to anticipate a sudden change of strata (and consequently resistivity) below this depth, it would be preferable to drive a number of electrodes and connect them in parallel. An example of the use of exceptionally long electrodes is given by R. M. Schahfer.* In a stretch of twenty-three consecutive overhead-line towers the footing resistances ranged up to 42 ohms. All were reduced to 6.5 ohms or less, and this required from two to eight rods in parallel at each tower. Many had to be from 50 to 80 ft. long, and one 31.8 ohm tower was reduced to 6.5 ohms by connecting in parallel one 75 ft. and one 105 ft. rod. Such electrodes could not be installed without mechanical means, and pneumatic hammers were used.

What may be called the efficiency of an electrode is the conductance per unit length. In a soil of uniform resistivity this falls steadily as the length increases, but since the resistivity is rarely uniform, this does not apply in practice. In some cases peak valves occur at a shallow depth, but in others the efficiency is actually increasing with depth after about 4 ft. This indicates that at such a site it is probably more advantageous to increase the length of the electrode than to drive several and connect them in parallel.

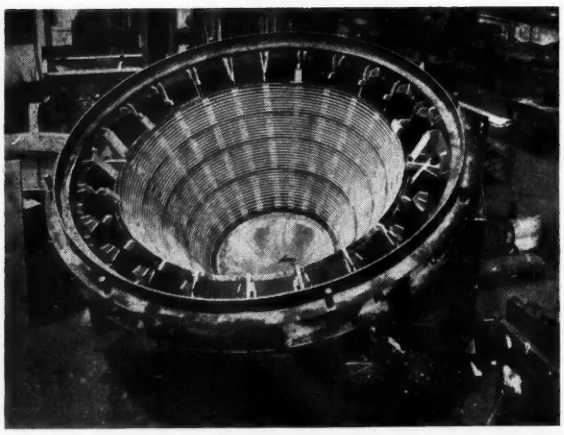
Acknowledgment is due to the North Metropolitan Electric Power Supply Co. for the provision of sites and assistance in the tests, to the British Insulated Cable Co. for the Copperweld earth electrodes, and to Mr. A. H. Bennett and Mr. G. F. Shotter for considerable help and valuable suggestions.

Electrical World, Vol. 109, p. 1843, 1938.

Dual Frequency Steel Furnaces

TWO 5-6 ton capacity conical crucible dual frequency furnaces built by "Asea" for the Avesta steel works in Sweden are designed to permit both the smelting of steel and its decarbonisation and refining.

Each furnace is built inside a steel casing of trunconic shape, surmounted by a cylindrical section which serves to provide extra space above the top of the molten metal. Inside the conical portion of the casing the magnetic screen, consisting of a series of packets of thin sheets held together by clamps, is provided. Over this magnetic screen the conductors are laid. These are composed of thick-walled copper tubes, covered with a special ceramic insulation intended to be insensitive to differences in temperature. Tests carried out by running cooling water through the centre of the tube and then attacking the insulation with a blowlamp failed to cause any cracks, even in insulation of 0.2 in. thickness. The conductors are all connected in such a way as to permit cooling water to circulate through them during the operation of the furnace and so prevent their heating up through the crucible walls.



One of the dual frequency steel furnaces during construction, showing the conductors surrounded by the magnetic screen in the furnace casing

The whole of the winding is supported on a series of clamps projecting out from the magnetic screen, so that there can be no contact between the screen and the conductors.

The crucible, in fire-resisting material about 5 in. thick, is laid over the winding and baked to form a thin crust of sufficient mechanical strength to support the charge. The upper cylindrical part of the furnace has no conductors or magnetic screen, though the crucible rises up inside it. This is because this part is not intended to hold metal during fusion.

The electrical connections of the furnace are very simple. The winding is provided with suitable lugs in a connection box fixed to one side of the furnace casing, so that it can be energised at high- or low-frequency, both at the same time. The h.f. is 1,000 cycles and the l.f. 25 cycles. Both are provided by generators on the same shaft and operated by a three-phase motor running from the high voltage mains. Each of these currents can be separately controlled, so that the furnace can be fed with either or both at the desired voltage and strength.

This regulation is necessary inasmuch as the h.f. serves for the melting of the charge, while the l.f. serves for agitating and mixing it during refining and decarbonisation. During this stage of the operation the h.f. is generally unnecessary, except in special cases when it may be desired to superheat the charge during decarbonisation. In order to provoke a proper direction of the agitation of the molten steel, the l.f. used is three-phase instead of single-phase as the h.f. A single-phase current provokes a repulsion of the charge from the sides of the crucible, so that the molten mass moves into the centre and bubbles up there, whereas three-phase current merely induces a rapid upward movement of the steel along the crucible wall, so that the downward movement takes place in the centre of the furnace. This allows thorough mixing of the metal and the slag during refining.

Film Speech Reproduction.

By F. G. W. Tree, Assoc.I.E.E.

New multi-channel apparatus

TO enable a number of talks on exhibits to be delivered simultaneously in each of the four large halls in the United Kingdom Government Pavilion at the Empire Exhibition, Glasgow, film speech reproduction equipment of special design has been adopted; and this is the first time this equipment has been put into commercial service. The materials used in the construction of the halls, and the acoustics of the halls, called for particular attention in respect of "sound to noise" ratio, in order to obtain crisp-clear speech without undue reverberation. This was achieved by a special arrangement of the loud-speakers in the halls, by careful adjustment of volume, and by the characteristics of the reproduction equipment to be described.

The equipment constitutes a compact and almost completely breakdown-proof means of reproducing speech from film sound-tracks, and it is housed in a steel cabinet, which is divided into sixteen compartments. As shown in fig. 1, the left-hand compartments contain the supply and amplification devices, and the right-hand ones, the film-sound apparatus, with the associated twin driving motors in the bottom section of the cabinet. The equipment on each left-hand shelf is associated with the film-sound devices on the respective adjacent shelves, and thus, there is provision for six entirely separate channels of reproduction.

Four-millimetre Film

Dealing with the sound devices first, each of the six uppermost shelves is equipped as shown in fig. 2, and exceptionally small width film is used. The film is only 4 m.m. wide, is dyed by a special process, has no emulsioned surface, and the sound track (or tracks) is photographed right through the dye, which means considerably longer film life. As there is no emulsion surface to wear off, continued usage of the films does not affect their condition, and clearly defined images on their sound tracks remain unaltered, throughout the life of the films. During the first month at the Empire Exhibition each film was run-through over 4,000 times without showing any signs of wear, and it is expected that this will remain the case during the 28,000 runs of each film within the period of the Exhibition. Each film runs on hardened steel rollers, each of which will revolve 60,750,000 times on each film during the six months' service, and since sprockets are not used the movement of the film through the mechanism is smooth. Consequently, there is no sprocket-wobble with its associated likelihood of sound ripple, and thus speech is clearer from the outset.

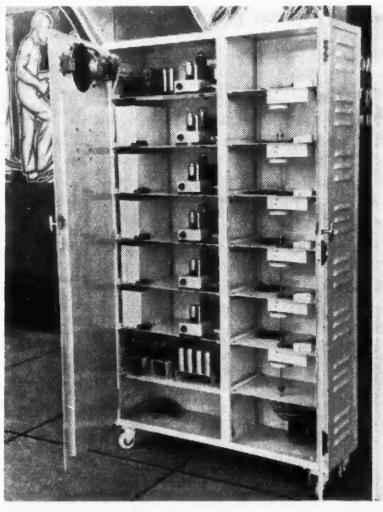


Fig. 1 (left).—The left-hand compartments contain the supply and amplification devices and the right-hand ones the film-sound apparatus, with the associated twin driving motors in the bottom section. Fig. 2.—Film-sound apparatus

The film of each channel is 300 ft. in length, has accommodation for two sound-tracks, and is normally used as a continuous band, *i.e.*, the two ends are joined together. The complete 300 ft. roll is wound round eighteen vertical rollers, each ¼ in. diameter, and the feeding or innermost "leg" of the film passes between two ⅜-in. rollers with ½-in. centres, positioned horizontally. In motion, the roll of film is pulled round the vertical rollers in a clockwise direction, but the base-plate on which the rollers are fixed remains stationary. The film is unwound by the pull exerted by the rubber-faced large roller (seen on extreme left of fig. 2) around which it passes, and it is held tightly on to this by a jockey-roller.

Theoretically, since the inner-circle of the film is much smaller than the outer one, it is impossible to run a continuous length of film in this manner, but, actually, the individual turns slide on one another, and thus equal tension exists on both "legs" of the film. As the film is drawn out from the centre the outer turns close in, and smooth movement is obtained. The field of adaptability of this film-sound unit is increased by the fact that, although 300 ft. films giving ten-minute talks are at present being used, longer films can be used, or, alternatively, sound-tracks photographed on both edges can be employed, without mechanical alteration. Two-track films enable double the length of speech to be obtained from any given length of film, or alternatively, two different talks can be arranged on one film. By inserting a 180-degree twist in the feeding "leg" at the time of threading the film the two tracks change their relative positions—from top to bottom—on completion of each film length, and in so doing each track comes within the scanning area of the photo-cell alternately and in turn. At this point it should be noted that, while the idea of running a continuous film in this way is not new, the mode of applying it and the mechanism for so doing had to be specially designed for this equipment. The "Ozaphane" specially processed films are, of course, a feature in themselves.

In the right foreground of fig. 2 is the exciter lamp, 6 V, 1 A, and the light from this is focused on to a small glass-tubed photo-cell situated in between the first two of the three rollers shown in a line on the photograph. Although the photo-cell tube is only about ½-in. in diameter, and an inch or so long, and its elements require no polarising current, it is definitely electron-active.

To reach the sound-track, the exciter lamp beam has to pass through a slit only two-thousandths of an inch wide, cut in a metal plate, and the accuracy of this slit determines the purity of speech obtained. The sound-track is variable area, and as previously mentioned, the area does not become affected by wear, as is apt to occur with emulsioned films.

To minimise the possibility of a complete breakdown of any one channel of this equipment, two film carrier units are positioned on each shelf, and this enables a quick change-over to be made. The driving shaft of each friction-grip roller has a flexible coupling, which enables the continuous films to be threaded round the rollers without having to "break" the films, and the individual shafts are linked together, to one of the two motors in the bottom right-hand compartment. Although the motors at present in use are of the capacitor-inductor type, any constant speed motor is suitable, and here again, in having provision for quick change-over from one motor to the other, lengthy breakdown of the equipment is unlikely to occur.

Supply Units and Amplifiers

The supply unit of each exciter lamp is situated on the extreme left of the shelves of the left-hand compartments, the low frequency amplifiers are in the middle, and the pre-amplifier valve-units are on the extreme right, almost out of sight, in fig. 1. Each of these units is of the simple plug-in type, and as also applies to the power packs, on the second bottom shelf, quick replacement is possible. These units are readily interchangeable, and as their plug-in contacts hold the units in position, no other fixing is necessary. The valves and the components of these units have no uncommon features, and thus, detailed description is unnecessary.

On the door is a monitoring loudspeaker, and operation of a selector-switch enables anyone of the six channels to be checked for speech-quality, volume, &c. The mains supply to the equipment is obtained by way of a plug-in fitting, and the cabinet being on wheels renders the entire equipment very mobile. In service in the Government Pavilion, absolute continuity of good quality speech is essential, and so far these equipments in each of the halls have functioned without a hitch. At the start of the Exhibition, however, some trouble was experienced with the acoustics of the halls, and background noises, due largely to different talks emitted from speakers in each hall, and to noises caused by visitors. Careful positioning of the loudspeakers was found necessary, and

Lift Installations. By "Logicus"

Rules to be observed

THE regulations of insurance companies, electricity supply authorities, L.C.C. (or local authority), Factory Act, and the Institution of Electrical Engineers have to be satisfied at some time during the installation of the modern lift.

Generally speaking, the prospective buyer of a lift does not possess the necessary qualifications to draw up the specification for the lift he intends having installed, and for this reason he puts this part of the work into the hands of either the architect, consulting engineer, or the firm that is to be entrusted with the work. In any case, the lift maker has to supply a machine that satisfies the specification and all that this entails. It is generally assumed that the acceptance of the specification by the client, despite the fact that it may not mention compliance with the regulations of the authorities, also places upon the maker the onus of meeting the requirements of these bodies in the matter of insurance, &c.

A main switch and fuses must be supplied and fitted by the lift maker or by the electrical contractor at the point of connection of the supply. A local switch or circuit-breaker must also be fitted as near as possible to the entrance of the motor room and in a conspicuous position for isolating the lift from the mains in the event of an adjustment being needed or of sudden emergency.

The purpose of this article is to point out the application of the various regulations. Reference is also made to some recommendations on lift practice that have been fairly generally adopted, and certain dangerous practices are also mentioned.

Where rectified a.c. control gear is used a neutral may be required and the question arises as to whether this should or should not be earthed. One midland supply authority has insisted that the neutral wire must be switched and fused, as, being earthed only at the station and capable of carrying a big potential above that of earth, it was a source of danger to other phase wires in the same tube. This, in view of No. 4 of the Electricity Commissioners Regulations, and No. 113 of the I.E.E. Regulations, is not allowable. The requirement is not set out in the conditions of supply of the supply authority in question, and was only accepted as the alternative to keeping two men in the town and a lift out of action till the matter was settled. This is only one instance of a supply authority imposing conditions that contradict regulations that were designed to prevent a much more serious contingency. Conditions of supply should be ascertained from the undertaking and verification of voltage, system and phase obtained in writing.

The a.c. supply to and the d.c. supply from the rectifier may not be run in the same tube. Fuses should protect the a.c. and d.c. sides of the unit, and the carrying capacity of all cartridges should be marked on them. This marking would have saved many a piece of apparatus that has had to be replaced due to careless re-fusing by a lift driver whose chief concern was to get running again after a stoppage.

The Motor Room

Where the walls of the motor room are of an inflammable material and are in close proximity to the machine or control panel, the L.C.C. or other local authority is certain to insist that they shall be covered with a fireproof material to minimise the danger due to arcs or to the machine burning out. Attention to this point when the motor room is being built will save time and money later when the machine is inspected by the authorities. Ventilation should be provided to prevent condensation on the machine or electrical plant.

All electric tubing must be run at least 3 in. away from any gas or water pipes, and all tube fittings used should comply with British Standards Specification No. 31. "Set" tubing wherever it is consistent with good practice. More damage can often be done drawing cabling round a multiplicity of bends, elbows and boxes than if a sensibly planned "set" tube circuit is wired. The last method is, of course, avoided by the "tube-crammer" type of wireman. Earthing must be effectively carried out, both in the motor room and in the lift shaft. The danger of an unearthed cage control or gate contact must be appreciated. It is bad practice to include an earthed core in the multicore trailing flexible from the half-way point to the cage, as a fault here to earth will tend to set the flex alight. Small contacts are sometimes overlooked when earthing, and the best plan where the tubing cannot be taken into the fitting is to earth these when the contacts are first installed.

Locks and such safety devices should always be wired on the "live" side of the control circuit so that in the event of contact insulation failing, the fuse will be blown and the lift brought to a stop. Should these be wired on the "dead" side of the circuit a fault would tend to short out the lock or contact, and circumvent its use. Attention must be paid to the stripping back of the braiding of all cables at their points of connection as, especially where moisture is present, neglect of this precaution will spell big call out charges. No cable of a size less than 1/.036 may be used on any circuit at supply voltage about the installation. This size, however, is not generally used, due to the risk that the only strand may not stand up to the pressure of the contact screw, and break off. For this reason, too, the use of 1/.044 cable is not favoured, unless the apparatus can be wired complete and sent on to the job without further attention.

Requirements of the Factories Act

In the Factories Act of 1937 there is a reference to the spacing and protection of switch-panels, which applies also to the lift control panel. A clear and unobstructed space of 3 ft. in front and 7 ft. above the panel is asked for, but where this is impossible, the panel is to be protected with a suitable metallic cover and electrically interlocked to ensure that the supply is disconnected before the covers are removed. A notice has also to be affixed to the cover to this effect. This also applies to an unprotected floor selector machine.

Joints of any description should be avoided in the circuit, but where necessary, they must not be drawn into the conduit with other wires but made in a proper tube box where they can be inspected. Cable forming should not be indulged in where cables of a size of 3/.029 are concerned. Good practice should never be sacrificed to a neat finish. A lift panel is not expected to possess the finish of a telephone exchange, and fairly large radius bends in the cables brought to the board for connection can look quite neat. Care should be taken that v.i.r. cable is not run too close to resistances. Asbestos cable should be used for internal panel connections in these positions.

Section 22 of the Factories Act requires that every hoistway or liftway shall be efficiently protected by a substantial enclosure fitted with gates equipped with interlocking or other devices to secure that the gates cannot be opened except when at the landing and that they cannot be moved from the landing until the gate is closed.

Hoists and lifts used for carrying persons must also have automatic devices to prevent the cage or platform overrunning and to secure that, when persons or goods are in the cage the latter cannot be raised or lowered unless the gate is closed and will come to a rest when the gate is opened.

Home Office Regulations

The Home Office Regulations now require that any controlling apparatus using electric power at a voltage exceeding 125 V a.c., or 250 V d.c., shall have on the "live" or conductor side a working passageway, having a clear minimum height of 7ft. and a width measured from the live conductors or contacts of not less than 3 ft., the floor being firm, even, unobstructed and covered by a fixed non-perforated indiarubber mat.

Where it is impracticable to obtain the minimum width of 3 ft., the controlling apparatus must be provided with enclosures or screens, approved by the factory inspectors, electrically interlocked, so that they can be removed only when the apparatus concerned is "dead."

These Regulations also stipulate that every hoist or lift shall be thoroughly examined by a competent person at least once in every six months and that a report of the result of the examination in the prescribed form shall be entered within fourteen days in or attached to the general register.

Insurance companies are reluctant to accept as a risk to-day a lift that is not provided with a cage gate with electrical contacts. The practice of allowing the movable floor and its associated contacts to cut out the cage gate when the cage is not occupied is, in my opinion, to be condemned as unsafe

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Film Speech Reproduction (*Continued from preceding page*)

also, the speakers themselves had to be suitably directional, to avoid overlapping of speech from one talk to another. To this end, it was found better to have two or more speakers on each talk-channel working at half volume, rather than one speaker at full volume, and in this way, more directional results are being satisfactorily obtained. Indeed, visitors listening to any one talk do not hear any overlap from other speakers, and thus, what would otherwise be "fair-ground" confusion is avoided. The cost of this new film-speech equipment per channel is less than that of any other comparable reproduction unit, but the total cost to meet specific requirements depends upon the numbers of channels required. The entire equipment was designed by Mr. A. J. Field, of Ozaphane, Ltd., London.

on lifts with a ledge inside landing doors or with landing gates, although some makers even claim this as a desirable feature on the ground that it is then unnecessary for the user to close the cage gate, but the advantage does not justify the risk.

It has become the practice of certain makers to arrange the limit switches to break only the control circuit of the lift and not the main. This can introduce danger should the main contactors "freeze" or weld (on copper-copper contacts), as they have done in my experience. Wires feeding bell and landing signals at a low voltage must not be run in the same conduit as those carrying a higher voltage, neither may they be run in the same multi-core flexible cable. A bell transformer, if used, must be fed through a pair of fuses, and the transformer windings must be double wound. As the transformer is likely to be connected to the mains permanently, it is false economy to provide one that has not an insulation of the very best. One side of the secondary winding should be earthed. Alarm bells with push-in cages should be fitted to lifts in enclosed shafts, with doors at openings.

Lighting Points Necessary

A lighting point should be fitted in the motor room of every lift. Many of us have had to carry out inspections or adjustments in the more-often-than-not confined and cramped space of the average motor room, without a convenient lighting point to make our job safer and quicker of completion. The lift maker should insist on a lamp being wired to give a good general illumination, and the provision of a plug point and lead for light in those awkward corners of the plant where close illumination is necessary. The switch for this lamp should be as near as possible to the entrance of the motor room, and in a conspicuous position, as it is generally the first thing required. A light is also provided in the lift cage, which will have to be wired from the "half-way" point of travel of the cage from the nearest available fuseboard of the building lighting system. The switch is generally incorporated in the plate enclosing the main pushbox, and care must be taken that the regulation dealing with grouping of a.c. and d.c. wiring is not transgressed in cases where the lift is supplied by one system and the lights by another. Care must also be taken that suitable ventilation is provided for the cage lamp, where this is enclosed by a fitting that is positioned against the cage woodwork. It appears to be impossible to obtain a lamp of the strip type to stand up to the stops and starts of normal lift duty, so making it extremely difficult for the lift maker to provide the cage with some of the very beautiful effects of indirect lighting for which a lamp of this type is eminently suitable. (The comparatively recently introduced architectural strip lamp appears to offer a solution to the problem due to its more robust filament support and lower operating temperature.)

At least three rope clips are required to secure the rope ends at their points of attachment. They must be fitted so that the saddle of the clip is around the short end of the rope and the plate and nuts are tightened on to the standing part of the rope.

Clamp anchorages that tend to cut into the braiding due to their sometimes great weight on a long travel lift and a badly designed grip should be avoided. This is a point that is often overlooked by the contractor. None of the weight of the flexible should come on to the connecting bar and subject it to any strain. C.t.s. flexible should be supplied where weather conditions are liable to affect a taped and braided cable, or where a wet pit is expected.

Satisfying Supply Authorities

Most supply authorities are satisfied if the machine and its associated wiring show a minimum insulation resistance of one megohm, and they can see the motor running. They may withhold the supply if the resistance is of a lower value than this, and if for any reason the motor blows fuses that should normally stand up to the starting and running current as shown or deduced from the information given on the motor plate. There are sometimes, however, local regulations and by-laws that the undertaking will insist on enforcing, *e.g.*, the fitting of circuit-breakers or silver fuses of the cartridge type. the ratio of the starting to the running current, and the value of the starting current itself. A copy of these regulations should be obtained as they have often a bearing on the type of motor and control that will be accepted.

Artificial Fertiliser Manufacture. By E. T. Ellis

ELECTRIC ovens for the manufacture of certain types of artificial fertilisers and manures have been used in this country only to a very limited extent. They have been highly successful elsewhere, however, and there is no reason why, with electricity becoming cheaper, large quantities of fertilisers and manures which are in keen demand should not be produced economically in England also.

The use of electric ovens

A common belief in England that electric ovens are only suitable for the manufacture of one or, at the most, two types or artificial fertilisers and manures is incorrect, as the electric oven can be adapted to deal with a very wide range of these. In certain cases evaporation is of major importance, but in most instances destructive distillation is to be recommended.

The adaptability of electric ovens enables them to be designed to produce given quantities of ingredients, *i.e.*, as near as within half a ton of the gauged amount. When orders come in for exceptionally large or small quantities, a larger or smaller number of ovens can be put into operation, with consequent saving in energy.

Chief Advantage of Electrical Method

The heat range adaptability of these ovens is their most important characteristic. Some processes require only a very moderate heat, while others demand sufficient heat to char or actually to oxidise the raw materials completely. Again, by modifying the design of the ovens we can easily evolve an economic pattern, using the original coke oven as a model, and having overhead charging combined with a back push out on to the usual quenching platform.

Electric ovens are especially applicable in the following four cases, *viz.*, for the production of phosphatic fertiliser, potash fertiliser, nitrogenous fertilisers and manures and mixed manures.

In the preparation of phosphatic fertiliser the usual starting point is the butcher's bone, and it is often advisable to dry this as an initial step at a low heat. After degreasing, in which every atom of fatty matter is carefully removed, the bones are introduced a second time into an electric oven at low heat, in order to evaporate all traces of solvent. The latter is, as a rule, exceedingly volatile, and in some instances worth recovery by means of fans and other arrangements in the flues. The next step consists, as a rule, of packing the bones into ovens of large size, breaking the bigger bones before the ovens are closed, and ramming them well.

When the electricity is switched on the limited supply of air in the ovens enables some of the carbonaceous matter to be oxidised. By intermittent admission of air the rest of the carbon is satisfactorily burnt off in due course, and a mixture of insoluble bone phosphate containing some carbonate of lime remains. This can be pushed out of the oven and quenched, but in many cases it is a better plan to allow it to cool in the ovens, *i.e.*, to have some of the ovens cooling while the others are in active operation. When cold, the material is raked out and introduced into lead-lined ovens fitted with mechanical stirrers, and strong sulphuric acid is run in. The resulting paste is spread on trays, which are reintroduced in ovens of moderate heat, so as to dry the material. The product is single or double superphosphate according to the amount of sulphuric acid employed, and requires to be well ground. As with other methods of manufacture, the phosphatic fertiliser must be stored so that there is no access of air, otherwise it soon reverts.

Making Potash Fertiliser

Potash fertiliser production is generally considered to be exceedingly expensive, but actually it is nothing of the sort. Very large ovens fitted with safety valves are called for, and the heat requires to be carefully controlled to avoid risk of explosion.

Wood waste, which can be sawn up wood ends, mixed joiners' wood waste, or (better still) wood shavings, is tightly packed into the electric ovens, which should be of the coke-oven type and completely filled so as to exclude air. After switching on, the heat must at first be kept very low in order to drive off moisture. The temperature is then raised so as to char the bottom quarter, *i.e.*, so as to utilise the oven to 25 per cent. of its capacity only, although it is fully charged at the time. By means of the safety valves, gas comes away without undue pressure, and when it ceases to be emitted, the current can be increased so that the oven is heated to half its capacity, with a similar result. When gas ceases to be emitted, the remaining half of the oven can be fully heated, as there is now room for sufficient gas expansion in the material below to avoid risk of explosion.

The gas that comes away is of value for illuminating purposes, provided that the heat is high enough, and merely requires a small amount of purification through lime towers, as a rule, after it has been washed to free it from the small amount of wood tar which it usually contains. What remains in the electric ovens is a black charred mass, if the operation has been properly conducted.

Air must then be admitted intermittently, and cautiously, so as to burn this carbon off completely, causing the contents of the oven to shrivel so that less than 25 per cent. of ash remains. This ash, instead of being black, is creamy white. Overheating at this stage must be avoided, otherwise some of the potash in the ash will be volatilised and wasted. Experience soon shows, however, when the heat is right, as the gas which comes off then consists of carbon dioxide only.

When gas ceases to be evolved the potassic ashes are allowed to cool in the electric ovens. They must not be quenched on account of the extreme solubility of carbonate of potash in ordinary water. The material is shovelled out of the ovens cold, and at once introduced into lead-lined tubs into which sulphuric acid is run, if sulphate of potash is wanted, or nitric

Some of the garment-marking machines in a large Liverpool laundry (see page 271)

acid, if saltpetre, a fertiliser valuable to exhibitors, is required. When phosphate of potash is wanted, phosphoric acid must be used, which is more troublesome, as the phosphate is exceptionally deliquescent.

In all cases drying of the fertiliser in electric ovens of moderate heat is called for, and this should be followed by fine grinding. Phosphate of potash must be stored at once in tightly closed containers, otherwise it absorbs moisture from the atmosphere as soon as the drying pans are withdrawn from the electric ovens.

Converting Meat and Fish Waste

Meat waste and fish waste are the two most convenient starting points for the manufacture of nitrogenous manures. Usually it is advisable to subject the material to a very moderate drying heat on trays in the oven, so as to get rid of a proportion of the moisture. This must be promptly done, as the waste has a disagreeable odour if it begins to putrefy, and even the most carefully controlled electric oven operation may be a source of nuisance for miles round.

After drying, the waste is degreased thoroughly by benzene or other processes of the extraction type, and again introduced into electric ovens of the tray type, and dried a second time at moderate heat in order to drive off all traces of volatile solvents.

Up to now the process is very much the same as with bones, but afterwards the methods are entirely different. Ovens fitted with a lining resistant to ammoniacal gases and to the action of caustic and quicklime, are required. If adequate safety valves are provided electric ovens of large capacity are perfectly safe, though the heat requires to be carefully controlled at first.

The dried waste is usually given one or more runs along an endless belt, so as to remove bony material, as fish bones or meat bones yield only a small amount of ammonia. These bones having been raked off by girls or youths armed with forks or rakes, the organic gut and offal is mixed with a small quantity of soda lime, potash lime, quicklime, slaked lime, or other active alkali, and packed as tightly as possible into the electric ovens so as to limit the amount of air.

Current is regulated to the amount necessary to cause the production of ammoniacal gases to begin and to be maintained in a regular flow, and is gradually increased until the evolution of gas ceases. These ammoniacal gases are then led at once into water, in which they dissolve very readily, and the liquor, as a rule, is boiled up with a further supply of milk of lime in order to increase the purity of the gas. The purified gas is then at once absorbed in vats containing sulphuric nitric, phosphoric, or other suitable acid, in order to produce sulphate, nitrate or phosphate of ammonia. Salammoniac (ammonium chloride) is used only to a limited extent as an artificial manure, but where there is a demand for it, the crude ammoniacal gases can be pumped straight from the electric ovens into chambers into which hydrochloric acid gas is pumped, where deposition of crude salammoniac at once takes place, this being purified by sublimation.

The final step consists of raking out the sulphate of ammonia and drying it in ovens of very moderate temperature—especially for nitrate of ammonia, on account of its explosive character. Ammonium phosphate requires to be thoroughly dried, as it is deliquescent, and must be stored at once in tightly closed containers.

Another Process

A method of manufacturing mixed manures that is in use abroad consists in mixing wood waste with fish or meat waste, free from bone when a nitro-potassic fertiliser is the object in view, and containing bone when a phospho-nitro-potassic fertiliser is wanted. In all cases, it is advisable to dry the material first at a moderate heat and to degrease it with benzene.

Reintroduction of the mixed waste into large ovens capable of providing high temperatures is the next step. The current is gradually increased, although the risk of explosions is very much less with a mixture than with a single material such as wood waste. Ammoniacal gases are emitted and, as before, are absorbed by an acid in order to produce sulphate or nitrate of ammonia, these two being the most important soluble nitrogenous fertilisers. Great care is taken not to overheat the nitrate of ammonia, on account of the risk of its decomposing with explosive violence.

The mixture left in the oven is then subjected to intermittent oxidation so as to burn off the carbon completely. We then have in one case a potassic ash similar to that produced when wood waste was originally employed, but containing a rather larger amount of insoluble matter. In the second case, *i.e.*, where the nitrogenous organic matter contains bones, we have a mixture of potassic and phosphatic ash from which the soluble potash can be very easily bleached out, although this step is never, in fact, taken.

Treatment of both materials with sulphuric acid is the usual step, and this is followed by drying the materials on trays reintroduced into electric ovens of very moderate heating capacity. In one case we get a crude sulphate of potash, and in the other case a mixture of sulphate of potash, superphosphate of lime and a few unimportant impurities. A proportion of the sulphate of ammonia or nitrate of ammonia can be mixed with either of these, in order to produce a nitro-potassic compound fertiliser in one case and a nitro-phospho-potassic compound manure in the other.

Two-torque Motor Switch

A NOVEL switch for controlling motors has been developed by the London Passenger Transport Board, 55, Broadway, Westminster, London, S.W.1, for the purpose of actuating electric starters for internal combustion engines on road vehicles. This new switch may be used with the normal type of series motor in order to obtain a reduced pinion speed when the pinion enters the rack, and then maximum torque when actually starting the engine. This switch was developed in 1937 and, following some early tests, an extended test with twenty-five switches is at present in hand. They are being used with starters both on oil and petrol engined vehicles. The switch can be designed for any voltage, the values of the induction coils and resistances being modified accordingly.

Miners' Lamps and Telephones

NEW regulations have been made by the Board of Trade (1938 No. 797, Stationery Office, price 1d.) and will come into force underground in coal mines on March 1st, 1939. Part II, Reg. 6, states that for the purpose of his inspections (except in small mines or those in which inflammable gas is unknown) a fireman, examiner or deputy shall have with him both a flame safety lamp and an electric safety lamp, or one safety lamp combining the two, each of which shall be of a type approved for that purpose. Part III, Reg. 8, requires all telephones and signalling apparatus intended to be used in underground areas where safety lamps are needed to be of types approved by the Board of Trade as regards safety in respect of inflammable gas. A list of types which have been officially certified and the conditions governing their use will be found on pages 27-35 of the annual "Regulations and Orders relating to Safety and Health" (1938 edition, H.M. Stationery Office, price 1s. 6d.).

The British Association Meeting

Further interesting discussions

A GREATER attendance than in recent years was attracted by the meeting of the British Association which opened at Cambridge on August 17th under the presidency of Lord Rayleigh (whose inaugural address we reported last week). By Thursday the number of tickets issued approached 2,800.

It was announced that a new division is to be set up to further the objective study of the social and international relations of science, dealing with the effects of advances of science on the well-being of the community and of social conditions on advances in science. Considerable interest is taken in the subject by the American Association for the Advancement of Science.

In his presidential address to Section G—Engineering, Prof. R. V. Southwell discussed "The Changing Outlook of Engineering Science" under three heads, *viz.*: teaching, research, and relations with the community.

Circumstances to-day, he said, forbid a policy of isolation because engineering is not a separate branch of natural philosophy, but natural philosophy studied from a particular standpoint with a special purpose. Two main causes of change recently have been (1) the trend of physics, which has altered the relations of pure and applied science, and (2) the growth of industrial and governmental institutions concerned with scientific experiment.

The dilemma confronting teachers is that, on the one hand, more and more specialised knowledge finds application in engineering practice while, on the other, industrialists require students not as incipient specialists but as men educated to take wide views and to think, and qualified to negotiate and control. Instruction given in colleges should be limited to that which can really be assimilated and not by lengthening or intensifying engineering courses. The demand is for men of personality, with a real and ready knowledge of engineering. The divergent pursuits of students termed "undergraduate activities" are often more essential to the development of the desired qualities than are examinations. Neither are examinations the best detectors of ability to do research, which cannot be taught, and harder papers should be shunned.

The two aspects of training, academic and workshop, must be regarded as an integrated whole and not as distinct phases. Consultation with industrialists would enable consideration to be given to the omission from the curriculum of items that are never likely to be applied in practice or are more easily learned in the works.

The aim of university research will be to break new ground in the physics that has application to engineering, later turning the problems over to men who command greater facilities, but who are limited in their choice of problems by practical considerations.

Instead of defending their activities from the charge that evil may come of them, engineers should attempt to instil into the mind of the public a clearer notion of the aims with which real scientific work is done, to show that the engineers and scientists seek truth because they must.

Oscillograph Demonstration

A new departure this year was to invite junior engineers to submit short papers. In this series was an oscillograph demonstration on Thursday of transients in transformers by Mr. F. B. Greatrex. The author used a recurrent-surge oscillograph comprising (1) an impulse generator operated from 50-cycle mains to give an impulse once every cycle with a peak value of 600 V, and (2) a cathode-ray oscillograph associated with time-sweep circuits interlocked with the impulse generator. A great advantage of the recurrent-surge oscillograph was that it operated on low voltages, thus avoiding risk of damage to the apparatus under test, and allowed a complete examination of the voltages developed, measuring them as a percentage of the applied voltage.

The impulse, seen as a stationary image on the screen of the cathode-ray oscillograph, had a wave front of one micro-second and a tail variable from 50 to 1,000 micro-seconds. He used 100 micro-seconds as being representative of usual lightning surges with a time sweep having a horizontal length of 1,000 micro-seconds, but capable of alteration to examine different parts of the wave.

Among the demonstrations carried out was one showing the effect of impulse applied to the low-voltage winding in inducing a large voltage in the high-voltage winding. Normally, this would not be serious because the h.v. winding was usually connected to an overhead line, and connecting a resistance of, say, 500 ohms across the winding reduced the voltage enormously. The experiments were made with reinforced end turns. It would appear that the increased voltage further down was due to oscillations at the end turns which had a natural frequency of their own and introduced spurious oscillations into those occurring at any point.

This demonstration was followed by another "junior" paper by Mr. J. E. M. Coombes, outlining the methods employed in the suppression of radio interference caused by trolley-buses. Interference from the make and break of the main contactors was, he said, small. If the trolley wires were badly oxidised, crackling in receiving sets might be considerable, but the substitution of carbon brushes for trolley wheels had improved matters. Suppression was by means of a choke coil or a double-wave stopper coil (two per vehicle). The author described a self-contained instrument he had devised to measure rapidly the impedance of the coils from 200 to 2,000 metres; this consisted of a variable capacitance, a fixed inductance and a variable resistance with a voltmeter. Such coils did not prevent radiation from the bus wiring. It was better to suppress each source of interference separately, and a draft B.S.S. had been prepared based on the recommendations of the I.E.C. and the International Broadcasting Union.

Interference from the trolley wires could be suppressed by keeping the wires clean, and by connecting condensers between them and earth at regular intervals. Closed-circuit choke coils weighing only 2 or 3 lb. each provided an alternative to double-stopper wave coils, which weighed 50 lb. each. Condensers across the brushes of motors and trip coils with high impedance over the medium- or long-wave bands fitted in leads to the control circuits of the contactors were also employed.

A Portable Moving-coil Vibrometer

Among other short papers by junior engineers was one, on Friday, by Mr. G. C. Eccles, describing a portable moving-coil vibrometer. In order to minimise the effect of resonances, the natural frequency of the instrument had to be as low as possible, and the lowest recorded was rather more than twice the instrument frequency. A moving-coil loudspeaker provided the permanent magnet and speech coil assembly. The magnet was spring-suspended (thus tending to remain stationary), while the lighter speech coil moved in sympathy with the ground; an e.m.f. proportional to the velocity of movement was thus generated in the coil. The output of the pick-up was applied to a gas-focused cathode-ray tube through a three-stage amplifier giving alternative amplifications of 400 and 2,000 with single-sided deflection.

The low impedance of the moving-coil instrument permitted the use of long connecting leads between pick-up and amplifier. As the recording gear was not portable leads up to 400 ft. might be required for exploring a large building; the insertion of a small low-pass resistance-capacity filter at the amplifier end to by-pass radio-frequency interference eliminated any difficulties. Over the range of frequencies covered, the frequency response of the amplifier was constant within 5 per cent., whilst the attenuation of the filter was about 1 per cent.; but these figures could be reduced.

For continuous recording a roll-film container was fitted to the back of a plate camera, the film speed being about 7½ in. per sec. A synchronous clock motor marked the time on the record; the spindle was fitted with a radially-slotted disc, one side of which was illuminated, the number of slots being devised to give flashes of light at 0.01 sec. intervals, which were reflected into the field of view of the camera by a mirror and focused on to one edge of the film.

Visits arranged for Thursday and Friday afternoons included those of the Mathematical and Physics and Chemistry sections to the works of the Cambridge Instrument Co., Ltd.

Monday's programme provided for a discussion between the Engineering and the Mathematical and Physical Sciences sections on magnetic measurements with special reference to incremental conditions.

The chairman (Prof. W. Cramp) referred to the paper presented by Dr. L. G. A. Sims at the 1935 meeting and his subsequent investigations which showed the need for a standard specification in regard to apparatus employing iron excited simultaneously by a.c. and d.c., including strong superimposed fields involving distortion. The general view was that sinusoidal induction rather than sinusoidal current should be adopted, that the method of test should depend upon a.c. and not the ballistic d.c. system as used for ordinary 50-frequency iron and that higher frequencies than 50 cycles should be included. The work was divided between Birmingham University (comparison of methods of measuring losses) and the Northampton Institute (comparison of ballistic with a.c. methods and the use of rings and cores for testing). Work so far had been limited to 50 cycles and silicon steel.

Mr. C. E. Webb (N.P.L.) pointed out that the highest permeability and smallest hysteresis loss were attained by eliminating internal stress and utilising the most favourable crystallographic directions. The characteristics of nickel-iron alloys had been improved by the addition of small percentages of other constituents, while the effect of cooling in a magnetic field on permeability was very great with alloys containing about 65 per cent. nickel. Permeabilities of 1,400,000 had been reported for pure-iron, iron-silicon and iron-nickel but the limit had not been reached.

Mr. D. C. Gale suggested that while the a.c. potentiometer was satisfactory for incremental testing under laboratory conditions, a comparison method was to be recommended for acceptance tests. If ring specimens were used *H* could be calculated accurately from the current but with permeameters *H* must be measured close to the specimen. Reliable permeameters for use with superimposed a.c. were not available, but they could be used with the incremental d.c. methods—a point of importance in the application of the ballistic method.

Dr. L. G. A. Sims and Mr. J. Spinks in a joint contribution expressed the view that, in regard to silicon steels, measurement clauses could probably now be drafted. They stated that close agreement existed between ballistic and a.c. measurements so long as a low-frequency sine wave of current was employed. They considered that their series of tests has established the ballistic test as a reliable and powerful means of exploring for a wide range of different forms of sample.

Mr. J. Greig and Mr. J. E. Parton pointed out that the harmonic content of exciting current could be measured readily and that the square of this quantity multiplied by the d.c. resistance of the exciting circuit gave the discrepancy between potentiometer indications and total loss in the iron. They suggested that these quantities should be used in determining practical test conditions.

Mr. E. D. Glazier and J. E. Parton showed that the differences in incremental quantity and iron loss values measured on rings and on transformer coils of the same material varied with the degree of polarisation and could not be entirely attributed to the unavoidable gap in the transformer assembly.

Mr. J. F. Stanley (B.S.I.) gave it as his view that the B.S.I. should reach final decisions only after having had an opportunity of considering all the opinions expressed during the meeting.

Mr. G. R. Sankey said that if manufacturers were kept in touch with developments they could tell whether the demand was likely to be enough to justify putting down a complete plant for the purpose.

Mr. W. F. Randell (T. C. & M. Co.) remarked that as the factors involved would be exaggerated in the case of nickel-irons, further experiments on these alloys were called for.

Dr. E. H. Rayner (N.P.L.) suggested that a specification should be issued with the proviso that it was not to be regarded as a B.S.S. until it had been confirmed.

The meeting decided to ask the Committee of the Engineering Section to accept next year a further report.

The afternoon was taken up by a visit to the works of Pye Radio, Ltd.

Magnetic Alloys and X-ray Structures

Included in the agenda of Section A (Mathematical and Physical Sciences) was a symposium on Magnetic Alloys and X-ray Structures. Introducing the discussion, Prof. W. L. Bragg commented on the enormous improvement in magnetic properties of materials used for technical purposes during the last twenty years. While there was a natural limit to the saturation value of magnetisation in a strong field, the advance in permeability, which measured the ratio of magnetisation to the field producing it, had been extraordinary. One result was the use of iron-nickel alloys of high permeability in the construction of submarine cables enabling many more messages, free from distortion, to be sent in a given time.

Coercive force was a measure of the field required to destroy magnetisation and in the core of a transformer, for example, where the direction of magnetisation was reversed many times a second, the coercive force should be as low as possible. The hysteresis loss (*i.e.*, work done in each cycle of reversals) could be reduced from 20 to 0.00003 in special cases. For permanent magnets, however, high coercivity was required; tungsten steel was a great improvement on the old carbon steel, yet it had a coercive force of only 80 units, whereas 900 units was claimed for one of the new alloys.

Dr. E. C. Stoner referred to the general theory of ferromagnetism as concerned with: (1) the magnitude of intrinsic magnetisation and its variation with temperature, and (2) the relation between the intrinsic magnetisation and the apparent magnetisation of the material as a whole, as affected by applied fields. Technological interest was centred in relatively low applied fields. The form of magnetisation curves depended on secondary effects; thus the energy required for magnetisation in a single crystal varied with direction modified by strains, the cube edges for iron, for example, forming six equivalent easy directions. For an understanding and control of properties of alloys, X-ray methods were essential but would not alone solve the problems.

Dr. A. J. Bradley stated that the magnetic properties of a material depended largely on the arrangement of its atoms. In "soft" material used for transformer cores they were regularly aligned in two main ways: (a) at the corners and centres of cubes, and (b) at the corners and centres of cube faces; alloys rich in iron belonged to (a) and those rich in nickel to (b). For producing permanent magnets such metals as copper, aluminium, carbon were added, associated with heat treatment at about 1,100 deg. C., in order to break up the orderly sequence of atomic arrangement, introducing strains and thus increasing the coercive force. Different rates of cooling affected the changes introduced, which were either of structure or of solid solubility limits.

The variation of magnetic saturation intensities with temperature in the iron-nickel-aluminium system was dealt with by Dr. W. Sucksmith, who referred to a new method of measuring saturation intensity (in fields up to 18,000 gauss) from liquid-air temperature up to the Curie temperature. The method required only 0.05 grm. of the alloy and was independent of the shape of the specimen. It showed that the phase boundaries as determined by magnetic methods corresponded closely with those given by X-ray investigations.

Improvements in magnetic properties in a particular direction by cooling the alloy in a constant magnetic field were discussed by Mr. D. A. Oliver. This increased its remanence and energy content in the direction of the field and reduced it transversely to the field. Carbon was the most potent impurity, adversely influencing remanence and coercive force out of all proportion to the percentage present, but small quantities of titanium almost completely neutralised its effect.

Engineers' Contribution to Physics

A discourse on "The Contribution of the Engineer to Physics" was given on Monday evening by Prof. M. L. E. Oliphant. Probably the greatest contribution was, he said, cheap power with the means to utilise electricity. He showed the use that was made in physics of apparatus developed in the radio industry and gave a demonstration of the possibility of detecting single atoms in motion by means of radio-valve amplification. The work of Kapitza on magnetic fields of about 250,000 gauss was made possible by the engineering design of his machine. Investigations of the interior of the nucleus of atoms depended upon 2,000-kV apparatus provided by engineering firms. New forms of lighting for commercial purposes had given the physicist the definite characteristics of light he required and had also stimulated physical research in new fields.

Next year's meeting of the Association is to be held in Dundee under the presidency of Sir Albert Seward, who was a vice-president of Section A (Botany) during the Cambridge meeting.

Planning for National Development

FOLLOWING on the recent announcement of the Council of the Architectural Association that it was no longer able to carry on the School of Planning and Research for National Development, the Advisory Board has made the necessary arrangements to continue it under its direction, at its present address, 7, Bedford Square, London, W.C.1. The policy of the school will aim at giving a thorough and wide post-graduate education in planning, both local, regional and national, following upon the lines pursued in the previous year. Research work will form an important part of this training. Mr. E. A. A. Rowse has agreed to remain as Principal. The members of the board include Dr. A. P. M. Fleming (director, Metropolitan-Vickers Elecl. Co., Ltd.), Dr. G. W. C. Kaye (superintendent, Physics Department, National Physical Laboratory), and Mr. F. Pick (vice-chairman, London Passenger Transport Board), and Mr. V. Watlington (director, B.E.A.M.A.). The school will commence its academic year on October 4th. Applications for entry should be sent to the school secretary.

Power Station Economy

COUN. W. ASBURY, of the Sheffield City Council, has some interesting facts to tell following his recent visit to the Klingenberg power station which supplies half Berlin. The station uses a very low grade fuel, which, he was informed, cost only about 5s. per ton, plus about 7s. to transport it from Silesia. The fuel is pulverised, and the residue is sold as fertilisers at about 7s. per ton—about 2s. per ton more than the fuel originally cost. The entire absence of cooling towers is another remarkable feature. Instead there are large nurseries with hot-houses attached to the station, and the water which normally would pass through the cooling tower is used for heating the nurseries, and eventually passed back to the boilers.

Correspondence

Every letter must be accompanied by the writer's name and address preferably, but not necessarily, for publication. The Editors cannot accept responsibility for correspondents' opinions

Employers and the I.E.E.

YOUR editorial in the ELECTRICAL REVIEW of August 19th is very timely. Membership of the I.E.E. will be of little value in the profession until the conditions of membership are brought more into line with the advanced grades of the American Institute of Electrical Engineers. At the present time the conditions suit the theoretical scholar and preclude the able technical and practical electrical engineer save in exceptional circumstances.

My chief assistant who is in receipt of a substantial salary, for which I receive full value, was recently rejected as an Associate. He has had fourteen years of excellent technical and practical training and I would not continue to employ him if his ability was not first grade.

The writer is a technical specialist on industrial electrification schemes and is one of the highest paid engineers in the British Isles in this class. Associate membership even then entails the passing of an examination which would have been simple fifteen years ago but which to-day would merely denote redundant knowledge. The alternative is a thesis which is entirely unnecessary if the record of achievement for the last fifteen years is even only briefly examined.

The I.E.E. is not truly representative of the best personnel in the electrical industry and will not be so until it gives practical and sincere encouragement to engineers who are too busy to deal with red tape methods. This is not a personal complaint as I am completely indifferent to the I.E.E. as it is at present constituted, but still would like to see the Institution as deservedly popular as, and have the great prestige of, its contemporary in the United States. RECTIFIER.

Birmingham, *August 19th.*

Eastbourne Activities

I am surprised to note in your leaderette under the heading "Eastbourne Activities" (August 19th issue) that you have assumed that because, during the year ended March 31st, there has been a considerable increase in the installation of own-property electric cookers, water heaters, and immersion heaters, this arose owing to the activities of private electrical traders.

You are labouring under an entire misapprehension in this respect, as practically the whole of this increase is due solely to our intensive propaganda and publicity work. The main reason for the increase in privately owned domestic apparatus is in connection with building estates, where, in the rural area, it is usual to erect overhead lines for the distribution system. We canvassed those responsible for the development of the new estates and made it a condition that if they on their part would install electric immersion heaters in 90 per cent. of the houses erected we, on our part, would be prepared to supply the properties by underground mains and services without additional guarantee or expenditure being required other than the usual charge for excess service cable.

With regard to electric cookers, practically the whole of these were on two building estates, where the promoters were sufficiently enterprising to include in their equipment an electric cooker in each house. The same thing applies in regard to self-contained water heaters.

You will therefore understand that the private electrical traders did not in any way assist in the manner you suggest, and the resolution of the Electricity Committee recommending the termination of the existing arrangements (not agreement) with the local contractors whereby all sales of fittings are made through them is, therefore, not affected in any way. This recommendation, incidentally, was referred back at the last Council meeting for a report from the electrical contractors giving their views, and for a further discussion to be held. J. K. BRYDGES,

BOROUGH ELECTRICAL ENGINEER.

Eastbourne, *August 19th.*

H.v. Paper Insulators

I have read with interest your article in the REVIEW of May 6th last dealing with high-voltage insulators. The care and control exercised during manufacture prompts the question of the care of the paper type of insulator when in service and during storage.

Overseas customers, operating in climes subject to higher temperatures and more humid conditions than those obtaining in Great Britain, using switchgear equipped with bakelised paper bushings, must of necessity carry spare bushings and replace bushings when necessary, using local workshops.

Information of an authoritative and detailed nature dealing with the maintenance of bushings in service, storage of bushings, and the care required to be exercised in handling replacement work, would be extremely useful to engineers in fields far removed from Britain.

Would some of your well-informed readers be good enough to give readers at large the benefit of their experience on these matters? ANTIPODES.

Australia.

Social Functions and Benevolence

Most organisers of social functions in the electrical industry —for instance, the many dances, dinners and amateur dramatic entertainments arranged in connection with different firms and associations—consider that their task is quite complete if they have given everybody a good time and balanced the budget. Even greater satisfaction should be realised if there is a successful attempt to make a profit for application to some worthy cause. The indication of such an intention is often a strong extra inducement for people to buy tickets and attend.

Already many electrical functions are run in this manner and the proceeds given, as one would naturally expect, to the Electrical Industries Benevolent Association, but at this time, when the thoughts of people with a flair for this kind of work are turning towards their winter activities, it would be appropriate for those who are not yet working for the double purpose of entertainment plus benevolence, to consider attempting this higher fence during the 1938-1939 season.

Holborn, *August 19th.* H. SENIOR FOTHERGILL,
Secretary, E.I.B.A.

Leakage Potentials

It is unnecessary to trouble you with the answers to Mr. Gilbert's criticisms, in the ELECTRICAL REVIEW for August 19th, of the E.R.A. Report, Ref. F/T 102. His criticisms are practically identical with those which he made when the Report was read before the Institution of Electrical Engineers, and appear on pages 780/783 of the December, 1937, issue of the "I.E.E. Journal"; for those who are sufficiently interested the answers will be found on pages 788/789 of the same issue. H. G. TAYLOR,
Electrical Engineer,
COPPER DEVELOPMENT ASSOCIATION.

London, S.W.1, *August 24th.*

Photoelectric Cell Applications

THE rapid expansion in recent years of the sphere of application of photoelectric cells has made it difficult to keep abreast of developments in more than a limited field. Thus, a work attempting such a comprehensive treatment as "Photoelectric Cell Applications," by R. C. Walker and T. M. C. Lance (third edition; Sir Isaac Pitman & Sons, Ltd., 12s. 6d. net) must of necessity deal somewhat briefly with many aspects of its subject. Nevertheless, in revising the book for the present edition the authors have endeavoured to maintain its comprehensiveness and have added a short treatment of the most recent matters of interest, such as television and sound reproduction, in which photocells or photoelectric devices play a basic rôle.

It suffers, however, from several of the defects difficult to avoid in such a treatment. In the effort to include descriptions of a large number of applications, some of them are not as clear as they might be, and more care might have been exercised in revising the style of the text in a number of places. The main fault is, perhaps, the inclusion of large numbers of applications based on minor variations of the same electrical circuit, some of which appear to be of very limited application. In addition, the subjects of television, sound-on-film reproduction and photometry really need more extensive treatment than is possible in a volume like the present one. However, the parts of the book dealing generally with the characteristics of different types of photocells, the description of methods of use, and of circuits most suitable for different purposes, are, perhaps, the most valuable.

In view of the increasing popularity of photocells of the rectifier type, one might have expected to find more space devoted to their uses, but it is to be remembered that the output in watts obtainable from these cells is relatively small, while amplification in this case is difficult if not impossible for most practical purposes. Moreover, little is known about the life of the cells under the rigorous conditions often encountered. The authors have therefore done well to give their maior attention to the emission cell, which, in conjunction with a suitable amplifier, generally affords ample sensitivity and stability.

This book is a valuable summary, brought right up to date and containing a useful bibliography. J. S. P.

New Apparatus and Devices

for Domestic, Cooking and Heating, Lighting, Power and Scientific Purposes

A Wire Reel

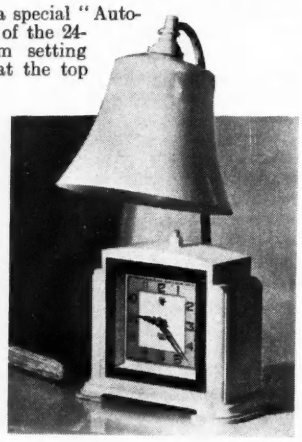
A NEW type of wire reel is being distributed in this country by SANDERSON & Co. (TEXTILE ENGINEERS), LTD., 5, Cross Street, Manchester. Known as the "Paco," the reel is manufactured from wood pulp, impregnated with a special water-resistant material, and the makers claim that breakage is practically impossible. The reels can be manufactured in any size up to 7-in. diameter flange, and the flanges can have the name of the purchaser embossed on them if necessary.

Plans are now afoot to commence manufacturing "Paco" reels in Lancashire.

Alarm Clocks

A new range of "Sectric" alarm clocks for the 1938-1939 season is being made by SMITHS ENGLISH CLOCKS, Cricklewood, London, N.W.

These clocks incorporate a special "Auto-larm" movement which is of the 24-hour type with the alarm setting knob conveniently placed at the top of the case. It is thus only necessary to set the alarm once for the buzzer to wake the sleeper every morning. The ringing is stopped by pressing down the alarm knob on top of the case. The clock will then be automatically reset for the next morning.



The "Alarmalite" clock

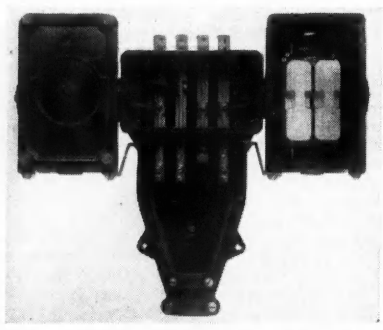
The "Pageboy," with simple moulded case, is similar in appearance to the "Callboy," which has the usual 12-hour alarm movement. In walnut finish, it has chromed bezel, figures and hands.

The "Alarmalite" is a novel combined "Auto-larm" clock and reading lamp, finished in ivory with glass ivory finished shade. The clock has a cream bezel with silvered zone and black figures and hands. The lamp can be swivelled in any position for reading purposes, and is already wired complete with a push-bar holder.

The "Bellboy" is similar to the "Perth" model, but has a 24-hour movement. The moulded case is of modern design relieved with a chromed bezel. It is produced in walnut finish with black figures and hands; also in ivory finish with gilt bezel, figures and hands.

Rising Main Junction Box

BRITISH INSULATED CABLES, LTD., Prescot, have recently introduced a type of junction box for use in blocks of flats. It is designed for tapping off on each floor v.i.r. cables in conduit from three- or four-core rising mains and is intended for use with the B.I. sandwich type cable. It can also be used with rubber or varnished cambric insulated mains. Designed on the unit system it consists of a central portion carrying vertical bus-bars, with cast iron fuse boxes attached at either side. Detachable cable pockets are provided for the incoming and outgoing mains. For use on the top floor the upper pocket is replaced by a cast iron cap. Either high rupturing capacity fuses or the semi-enclosed expansion type can be fitted. The fuse boxes are made in two- and four-way single-pole units with neutral bus-bars so that two, four, six or eight circuits can be provided from either side. Connections between the bus-bars are made with flexible rubber cables.



The B.I. rising main junction box

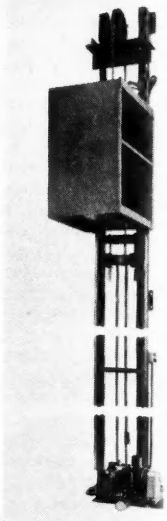
B.I. Cables now fit many of the 660-V disconnecting network boxes with high rupturing capacity fuses on black bakelite carriers and the wedge type link. Both fuses and links are tightened by the same method and one tool only is required to tighten, loosen or remove them.

The illustration shows one of their latest detachable pocket type boxes fitted with these fuses and links. In the photograph one of the pockets is shown with its cover removed to illustrate the method of connecting up to the cable.

An Electric Service Lift

A new product of BENNIE LIFTS, LTD., 2, Tinworth Street, Albert Embankment, London, S.E.11, is the "Electro-Waiter," a small electric service lift.

The entire equipment is contained in a ready-wired, self-supporting structure, enabling the lift to be installed in one unit by unskilled labour. The space required is 2 ft. 8 in. by 2 ft. 1 in. and the lift is adaptable to all types of buildings and can be fitted with a hot-plate or special trays for crockery, glasses or bottles. It is made suitable for d.c., single-, two- or three-phase supplies in two sizes, capable of carrying 56 lb. or 84 lb. at a rate of 50 ft. per minute.



The "Electro-Waiter" electric service lift

Electric Shaver

The "Oxford" electric dry shaver is being sold by OXFORD CLEAN SHAVER, 39, Clifton Street, London, E.C.2, and employs a new twin cutter with self-sharpening cutting surfaces and graphite-treated bronze bearings. The motor will operate on a.c. and d.c. supplies of 110-250 V, and special models are available for 6 and 12 V. The shaver is shortly to be made in this country.

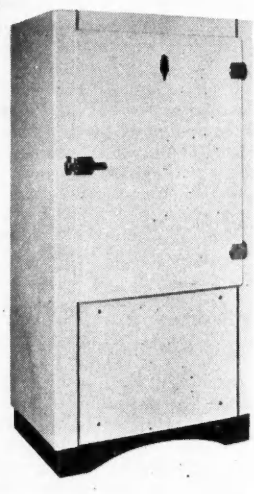
Injection Moulding Powder

A polystyrol resin suitable for injection moulding is now supplied by MAY & BAKER, LTD., 42-43, St. Paul's Churchyard, E.C.4. This resin, "Rhoddene M," has an injection temperature of about 142 deg. C., at which it flows freely, with working temperatures of from 175 to 210 deg. and readily leaves the polished mould surfaces when it is cooled down below 40 deg.

Very thin sections reproducing minute details in the mould are claimed to be realised in any translucent or transparent colour. The sp. gr. is 1.05 and the thermal conductivity 1.02×10^{-4} per 1 deg. C. Water absorption is stated to be negligible, which, with the low dielectric constant of 2.2 to 2.4 at from 50 to 10^6 cycles and hysteresis losses of 1×10^{-4} and 1.5×10^{-4} at 1,000 and 10^6 cycles, makes it suitable for use as an insulator. Its resistivity (unchanged by twenty-four hours in water) is given as 3×10^6 megohmns per cm^3, and its breakdown voltage as 1,200 kV per cm. with a sample 1 mm. thick.

A Low-priced Refrigerator

The CENTURY REFRIGERATION CO., LTD., 12, Princes Street, Hanover Square, London, W.1, is now putting on the market two larger models than hitherto with capacities of 6 and 8 cu. ft. at low prices. The 6-cu. ft. model has a shelf area of 11.2 sq. ft. and produces 56 ice cubes at one freezing. External overall measurements are 58¾ in. by 29 in. by 22 in. Because of wider shelf spacing the shelf area of the 8-cu. ft. model is slightly lower (10 sq. ft.). The ice production is the same, and overall measurements are 63 in. by 32 in. by 24 in.



The new 8-cu. ft. Century refrigerator

A new factory at Watford is now in full operation.

The "Cotto" Washer

We regret that owing to a misunderstanding the "Cotto" washer of COTTO PRODUCTS, Enterprise Works, Scunthorpe, was described in our issue of August 12th as having a manually operated agitator, whereas the machine is electrically operated. A motor causes the handle referred to on top of the washer to move to and fro and turn the paddles.

British Overseas Electrical Trade

In July the value of electrical exports was £1,797,811, the highest since March and £252,264 more than in July, 1937.

PRINCIPAL export activity in electrical equipment last month continued to be in machinery, with South Africa and British India as the chief destinations. Shipments of generating plant, motors, switchgear, transformers, &c., to the former totalled £220,192, an increase of £122,628 over July, 1937, and to the latter £164,622, an advance of £112,353. That the higher level was not due to a few large orders, however, is shown by the fact that substantial increases are recorded to many of the countries for which separate figures are given in the Board of Trade returns.

TABLE I.—EXPORTS AND IMPORTS DURING JULY

	Exports. July, 1938.	Exports. Inc. or dec. compared with July, 1937.	Imports. July, 1938.	Imports. Inc. or dec. compared with July, 1937.
Submarine telegraph and telephone cables	£4,312	− £1,681	*	—
Telegraph and telephone wires and cables (not submarine)	67,364	− 1,745	*	—
Other insulated wires and cables	232,558	− 89,444	£41,799	− £9,746
Radio receivers, not radiograms (excluding valves)	34,403	+ 7,451	14,994	− 1,225
Radio transmitters (excluding valves)	30,159	− 13,749	*	—
Radio valves	40,859	− 2,355	10,728	− 10,384
Other radio parts and accessories	33,016	− 22,893	60,756	− 24,215
Telegraph and telephone apparatus (other than radio)	277,855	+ 101,662	*	—
Electric carbons	*	—	4,723	− 7,415
Incandescent lamps	42,635	− 22,376	8,912	− 7,670
Other lighting apparatus	42,313	− 10,853	36,740	− 10,958
Primary batteries	15,946	− 3,297	*	—
Accumulators	47,599	+ 2,503	*	—
Electric cooking and heating apparatus	26,279	− 1,339	*	—
House service meters	16,852	+ 887	*	—
Other electrical instruments	22,561	+ 2,216	30,209	− 573
Insulating materials not elsewhere specified	18,474	+ 4,467	*	—
Unenumerated electrical goods and apparatus	128,598	− 10,599	66,534	− 9,897
Electric generators up to 200 kW	40,224	+ 16,125	*	—
Electric generators over 200 kW	92,451	+ 85,433	*	—
Electric motors	148,865	+ 21,900	24,519†	− 6,304
Convertors and transformers	95,092	+ 47,090	*	—
Starting and controlling gear for motors	58,144	+ 26,938	*	—
Switchgear	228,941	+ 106,763	*	—
Other electrical machinery	16,082	− 4,923	20,479	− 2,484
Electric vacuum cleaners	36,229	+ 14,083	17,661	+ 4,926
Total	£1,797,811	+ £252,264	£338,054	− £85,945

* Not classified separately. † Not railway and tramway motors.

In the machinery section as a whole (the only one of the twenty-one into which articles wholly or mainly manufactured are classified to show an improvement) the value of exports increased by £508,844, of which directly electrical machinery accounted for £313,409. In addition higher figures are also recorded for boiler-house plant, mining machinery, &c., a good deal of which would be of an electrical nature. The largest customer for machinery generally so far this year is British India, with a total of £4,860,687—more than £1,000,000 in excess of that for the corresponding period of last year. It is also interesting to notice that Russia is buying considerably more British machinery; actually the value to date is £1,387,196 compared with £353,018 and £460,151 in the first seven months of 1937 and 1936, respectively. Participation in the Italian market has also recovered well.

While electrical machinery exports advanced by £313,409 shipments of goods and apparatus contracted, but the decline was small compared with that of British exports generally, and may practically be set down to the fact that July, 1937, contained an additional working day. The net advance in electrical exports over the corresponding month of last year was £252,264 (16 per cent.) to a total of £1,797,811, which this year has only been exceeded in January and March.

Cable makers, who did very well in overseas markets last year, have this year experienced a smaller demand and last month's exports of insulated wires and cables other than telegraphic and telephonic were down by £89,444 in value. The chief destinations, with comparative values (July, 1937, in parentheses), were as follows:—

Rubber insulated wires and cables.—Australia, £30,153 (£43,451); South Africa, £17,577 (£37,210); British India, £16,678 (£17,438); New Zealand, £8,579 (£8,464); other British countries, £20,588 (£23,257); and foreign, £25,221 (£20,164).

Electric wires and cables, insulation other than rubber:—British India, £26,678 (£18,062); Australia, £22,743 (£43,756); South Africa, £22,129 (£47,047); other British countries, £26,571 (£34,241); and foreign countries, £15,641 (£28,912).

On the other hand, exports of telegraph and telephone apparatus other than radio continue at a much higher level than last year, although last month's total was less than that for June. An analysis of the chief markets is as follows:—Australia, £93,674 (£51,937); South Africa, £36,893 (£21,300); other British countries £70,077 (£48,738); Argentina, £21,868 (£9,830); other foreign countries, £55,343 (£44,388).

The number of complete radio sets, other than radio-gramophones, exported has steadily risen during the last month or two (May, 3,577; June, 4,478; and July, 6,017), last month's total comparing with 5,969 in July, 1937. The number of valves exported rose from 163,757 in July last year to 193,015, but there was a drop in value, while exports of parts and accessories were worth considerably less. Electric lamps sent overseas numbered 1,347,000 (against 1,985,000) and house service meters 14,224 (14,395), although in the case of the latter there was an increase in value.

Last month electrical equipment was imported into this country to the value of £338,054, a decrease of £85,945 (20 per cent.) as compared with the corresponding month of last year. Only vacuum cleaners showed an advance. In number, however, radio sets brought into this country rose from 6,573 to 7,281 (the value falling from £16,219 to £14,994), and electric lamps from 4,238,000 to 4,877,000 (with a sharp decline in value from £16,582 to £8,912). The chief sources from which electrical goods and apparatus were received last month were:

United States, £81,508 (£82,619); Germany, £78,196 (£94,047); Netherlands, £34,362 (£82,933); Belgium, £15,431 (£25,246); Switzerland, £14,089 (£20,821); France, £11,983 (£9,073); Austria, £2,514 (£5,420); other foreign countries, £21,966 (£26,871); and British countries, £15,346 (£10,448).

TABLE II.—BRITISH ELECTRICAL EXPORTS DURING JULY

Destination.	Goods and apparatus, July, 1938.	Inc. or dec. compared with July, 1937.	Electric generators, July, 1938.	Inc. or dec. compared with July, 1937.	Electric motors, July, 1938.	Inc. or dec. compared with July, 1937.	Other electrical machinery, July, 1938.	Inc. or dec. compared with July, 1937.
Eire	£28,653	− £16,621	*	—	*	—	*	—
Channel Islands	10,884	− 691	*	—	*	—	*	—
Palestine	10,588	+ 1,815	*	—	*	—	*	—
British West Africa	9,654	− 3,864	*	—	*	—	*	—
Union of South Africa	163,363	− 22,940	£43,530	+ £37,096	£40,726	+ £10,787	£135,936	+ £74,745
British India	118,455	+ 14,163	43,326	+ 39,749	18,263	+ 2,432	103,033	+ 70,172
British Malaya	25,901	− 3,721	*	—	*	—	9,476	+ 3,388
Ceylon	23,438	+ 12,256	*	—	*	—	*	—
Hong Kong	10,868	+ 2,324	*	—	*	—	*	—
Australia	206,033	+ 11,943	7,455	+ 3,342	16,000	+ 1,042	24,381	− 12,436
New Zealand	98,095	− 5,262	*	—	6,033	− 5,767	14,009	+ 2,317
Canada	7,469	− 13,522	4,001	+ 3,305	6,266	− 246	9,559	+ 7,745
Other British Countries	47,632	− 5,547	15,018	+ 6,911	16,007	+ 1,535	31,770	+ 5,325
Sweden	11,584	+ 921	*	—	*	—	*	—
Denmark	18,707	+ 132	*	—	*	—	*	—
Netherlands	11,837	− 522	*	—	*	—	7,019	+ 3,634
Belgium	11,130	− 1,210	*	—	*	—	*	—
France	9,977	− 13,174	*	—	*	—	2,404	− 1,885
Portugal	5,199	− 4,135	*	—	*	—	*	—
Spain	6,562	+ 5,346	*	—	*	—	*	—
Italy	2,799	− 4,809	*	—	*	—	*	—
Greece	9,795	+ 3,328	*	—	*	—	*	—
Rumania	23,992	+ 8,205	*	—	*	—	*	—
Egypt	10,705	+ 1,892	*	—	*	—	1,950	− 25
China	3,586	− 41,662	*	—	*	—	2,147	− 1,349
Brazil	9,052	− 2,723	*	—	*	—	*	—
Argentina	49,994	+ 13,915	*	—	*	—	3,338	+ 1,373
Other Foreign Countries	135,831	+ 3,018	19,345	+ 11,155	45,570	+ 12,117	53,237	+ 22,864
Total	£1,081,783	− £61,145	£132,675	+ £101,558	£148,865	+ £21,900	£398,259	+ £175,868

* Not classified separately. Vacuum cleaners are included in Table I but not in Table II.

The Lighting Campaign, 1938-39

Details of lamp manufacturers' publicity materials

HELPED by the E.D.A.-E.L.M.A. Campaign and the manufacturers' individual publicity schemes, dealers should find it a simple matter to increase their sales of lamps during the coming lighting season. If anything, advertising arrangements are more ambitious than usual and particulars received from a number of the manufacturers indicate that this season's publicity aids in the way of window display materials, posters, showcards, &c., will have even more appeal.

The value of artistic presentation is strikingly exemplified in the BRITISH THOMSON-HOUSTON CO.'S publicity material issued in connection with "Mazda" lamps. For a new campaign covering the whole country there has been prepared a poster on which appears a contour plan of the British Isles in ochre against a blue background. The words "Mazda Lamps" are in blocked red and white, and beneath is the 1938 slogan: "The nation's light," together with the already well-known phrase "They stay brighter longer."

Reproducing this poster on a smaller scale a cut-out has been prepared for window displays or on counters. It is supplied complete with lampholder, adaptor and flex, the whole design being arranged for illumination. The same theme is repeated on a showcard measuring 22 in. by 15 in. A special showcard of "Mazda" motor car bulbs has on the back a schedule giving particulars of the bulbs for practically all cars. A further showcard, approximately 18 in. by 13¼ in., features "Mazda" coloured lamps for decorative lighting.

A selection of new lamp publicity materials and sales aids

The new "Mazda" catalogue is more comprehensive than previous issues and contains fifty-six pages. The lamps described have been photographed against a curtain and are reproduced in half-tone across the top of the page, thus making for easy and clear reference. A two-page colour inset shows the various classes of coloured lamps available: the "Mazda" light tubes, gothic and newel lamps, "Longlite" lamps, sign lamps, candle lamps and fairy lamps, the "Mazda Mickey Mouse" and the new "Snow White and the Seven Dwarfs" lamps. Photographs of the company's works are also included, together with examples of street, flood and industrial lighting installations. The revised "Mazda" business guide contains information upon all types of lamps described in the main catalogue, illustrations being omitted. The general lamp folder includes particulars of lamps for household, decorative and automobile use, with illustrations in black and white and a reproduction of "The nation's light" design on the outside. Car bulbs are dealt with in a separate folder.

The main attraction of the METROPOLITAN-VICKERS ELECTRICAL CO.'S publicity materials will be an entirely new form of display device known as "Lightplastics." By the use of "fluid light" this novel machine presents a changing series of glowing shapes in the form of lamps or other internally illuminated coloured bodies. Supplied complete with flex and adaptor, the machine is in a strong case which opens to form a suitable display background.

Folding displays are available for "Cosmos" and "Metrovick" type "B" lamps, the use of chromium foil creating a bright and forceful effect. A new type of sticker for shop windows, showcases, &c., is easily mounted without water or paste and can be instantly removed and used again without leaving any mark on the glass. A few special displays are available for "Metrovick" electric discharge lamps.

The "Cosmos" lamp catalogue appears again in its standard form with thumb index, while the "Metrovick" electric discharge lamp catalogue has been enlarged to quarto size. A handy-sized pocket price list is issued for the trade, and quantities of a new little booklet containing interesting information on home lighting are available for overprinting.

The National and Trade Press will again be employed by SIEMENS ELECTRIC LAMPS & SUPPLIES, LTD., for their main appeal, displayed advertisements commencing when public demand is greatest and continuing through the winter months.

An exceptionally striking window display in clear, well-balanced colours cannot fail to arrest attention. It is packed flat and opens out in three planes. The central feature, maintaining the association of Siemens with "Big Ben," shows the clock tower of the Houses of Parliament floodlighted and standing out impressively against a night sky of rich blue. The tower and clock-face are printed upon a semi-transparent material, so that when illuminated from the back the effect is charmingly realistic. The caption is the familiar one: "Used for lighting Big Ben and just as reliable." In the foreground are pleasingly modelled houses, the windows of which are also illuminated.

In the new showcard the floodlighted tower of "Big Ben" in an artistic setting is again the principal feature. An eagle design counter showcard incorporates a device for holding the attractive leaflet of Siemens pearl, opal, clear and automobile lamps, which can be supplied overprinted with the dealers' names and addresses.

An extremely forceful programme has been planned by the GENERAL ELECTRIC CO., LTD. Two hundred million copies of advertisements extolling the merits of "Osram" lamps will appear in the Press during the campaign, over a thousand separate advertisements being inserted in the national and provincial Press, magazines, trading and industrial journals.

The now well-known slogan, "Osram—the wonderful lamp," will appear on strikingly designed showcards, cut-outs, illuminated window displays, counter devices and other compelling sales promoting aids, while "O for an Osram"

will this season be the cry of a sleepy child, who, awakened in the small hours, gets out of bed and goes downstairs in search of an "Osram." This theme is to form the basis of illuminated displays for shop windows. In addition there will

Ensign poster and showcard designs

be a window stencil design with "O for an Osram" in yellow. Users of London's underground railways will be urged by a striking poster to "Go by underground—alight by Osram."

The 64-page illustrated "Osram" lamp catalogue and various literature sales aids, &c., available to dealers, with particulars of the company's trading policy, are included in a well-produced broadside. Requests for over-printed literature (free on request) will be dealt with promptly.

To mark the sixtieth anniversary of the production of the first incandescent electric lamp by Sir Joseph Swan the EDISON SWAN ELECTRIC CO.'s publicity for the coming season includes a historical note linking the lamp of 1878 with the present-day "Royal Ediswan" lamp, a large-scale representation of which forms an important part of the window display centre-piece. This centre-piece is designed to illustrate a new slogan: "Better sight through better light"—last year's E.L.M.A. slogan taken a step further to give continuity to the two years' efforts.

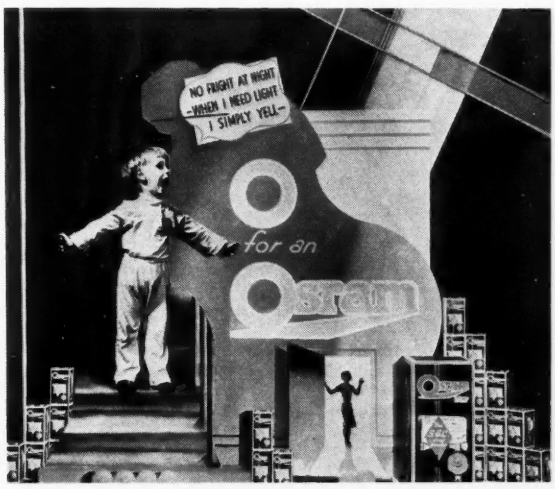
The manner in which this slogan is symbolised by the centre-piece is both attractive and forceful. The face of a woman, with clear and penetrating eyes looking through the lamp, suggests radiant physical fitness, and the appeal of the display is increased by the novelty of the lamp which, shaped from heavy acetate with a pearl effect, might quite pardonably be mistaken for an actual giant lamp recessed into the display. Surrounding this assembly is an aura of many colours suggesting light. The slogan above is lighted from behind, an imitation neon effect being achieved. Although it can be provided as a separate unit, this centre-piece is designed to accompany the complete "Ediswan" window display, the rest of which forms an appropriate background. The tallest tier of cartons leads the eye straight to the royal coat-of-arms—an unobtrusive reminder of the royal warrant.

A well-produced folder has been prepared by ENSIGN LAMPS, LTD., to describe their plans for the coming season. "The best light for all ages" will be the principal slogan running through the publicity matter and Press advertising, which will generally include two or more figures representing different generations. The long life of the lamps will be emphasised, while special showcards, &c., will draw attention to the "Brilliance with economy" of the "Ribble" type "B" lamps. A full complement of sales materials for counter and window display will be available, covering both "Ensign" and "Ribble" lines, and in addition to the Press advertising a colourful 16-sheet poster will be exhibited at certain provincial centres.

Production has recently commenced at the company's new works which have been equipped with the most up-to-date machinery. With a floor space increased from 26,000 to 60,000 sq. ft. facilities are now available for more than doubling the output of lamps.

CROMPTON PARKINSON'S familiar hat theme is superseded this year by a scheme utilising the slogan: "You'll seldom buy lamps if you always buy Crompton," thus emphasising the record of the lamps for long service. Considerable space has been taken in the national Press where amusing illustrations will show the inconvenience often caused when it becomes necessary to change a lamp. The national advertising will be supported in the provinces by an extensive poster campaign.

Five new Crompton displays are available to dealers, in addition to two showcards retained from last year. Two illuminated cabinets for window display each extend to 6 ft., with a height of 4 ft. 6 ins., and have a centrepiece on which the main display is mounted, and side wings. A third multi-



This "Osram" window display is available in two sizes

plane window display, 6 ft. wide by 3 ft. high by 2 ft. deep, has a coloured background depicting a night sky scene, with the word "Crompton" and a large representation of a lamp in contrast.

A new counter device comprises a realistic plaster model of a hand holding an actual lamp, and an illuminated box sign bearing the message "May we advise you on your lighting?" will make more widely known the facilities Crompton Parkinson offer for giving expert service on lighting matters. Other materials available include a window sticker and an attractive counter price list.

In addition to the materials for Crompton lamps, arresting displays have been produced for the company's "Kye" lamps. They include a window display, counter showcards, cut-out window sticker and counter leaflets. In each case the name and price of the lamp are displayed prominently, and the slogan: "The original British shilling lamp" is featured throughout.

A "Kye" window display and a "Crompton" illuminated cabinet and counter novelty

Business and Industrial Notes

The Week's News. Showrooms and Exhibitions. New Installations. Overseas Trade. Publicity Material. Trade Announcements. Prices of Materials. Liquidations and Bankruptcies.

Key Industry Duty

THE Board of Trade has received applications under Section 5 (5) of the Finance Act, 1936, for licences to import free of duty the following:—A high-frequency sublimating furnace the generating valve of which is supplied with 6 A at 20 kV from an 8-valve rectifier, the excited frequency being approximately 500 kilocycles per sec., and the furnace being provided with protective devices against overload, flashover and backfire. One universal condenser X-ray apparatus giving currents up to 2,000 mA, and an exposure range down to 1/300th second operating by condenser discharge and fitted with a photo-electric protective device against overloading. One rotating shockproof X-ray tube. Any representation that similar instruments are made or are likely to be made within a reasonable time, in the United Kingdom or elsewhere in the dominions, should be addressed to the Principal Assistant Secretary, Industries and Manufactures Department, Board of Trade, Great George Street, London, S.W.1, within one month from August 15th.

The exterior of the new showrooms of the Sheffield Electricity Department

Employment in July

Employment showed little change generally in the engineering industry between June 13th and July 18th, and continued fair on the whole, being good in electrical engineering. According to the *Ministry of Labour Gazette*, the number of unemployed in the enginering industry was 93,039, an increase of 1,939 as compared with June and 37,410 more than in July, 1937, the percentage being 7.9 (against 7.8 in June and 4.8 in July, 1937). In electrical engineering the number of unemployed was 5,857, or 5.1 per cent., a decrease of 0.4 per cent. as compared with June, but an increase of 2.5 per cent. as compared with July, 1937. In the electrical wiring contracting industry there was a total of 4,976 out of work, representing a percentage of 12.1, or 1.2 per cent. more than in June and an increase of 2.1 per cent. as compared with July, 1937. In the electric cable, apparatus, lamps, &c., group the unemployed totalled 13,461, or 7.6 per cent. This is a decrease of 1.5 per cent. as compared with June, but an increase of 4 per cent. as compared with July, 1937.

Diesel Engine Contracts

The Diesel engine department of the English Electric Co.'s Rugby Works is engaged on a repeat order for a 3,500-b.h.p. Fullagar Diesel engine for the Bermuda Electric Light, Power & Traction Co. The first English Electric engine of this size for this undertaking was described in our issue of November 13th, 1936. The order for the duplicate plant was obtained against strong American and Continental competition. In the list of important orders in hand by the English Electric Co. are included a 1,500-b.h.p. two-cycle Diesel engine for Broken Hill Municipality in Australia, two similar engines for the States of Guernsey Electricity Department, and another for Port of Spain, Trinidad. Port of Spain is also the destination of two larger engines having a total power of 3,920 b.h.p. Other work in progress includes six engines of various sizes for the Admiralty, a large engine for the War Office, two 750-b.h.p. four-stroke engines for marine propulsion, through Voith-Schneider propellers, a 220-b.h.p. engine for an Indian coal company, a 440-b.h.p. engine for an Australian department store, and two engines totalling 770 b.h.p. for Canada.

A Survey of Chromium Plating

Although chromium plating for commercial purposes is a comparatively new industry, early researches can be traced back nearly ninety years. Interest in the development of the processes is such that W. Canning & Co., Ltd., have published "Chromium Plating: Historical Survey," in which the history of chromium plating is traced from the first patent taken out by C. J. E. Junot, in December, 1852, to present-day practice. The company claims that the first mention of commercial chromium plating in this country appeared in the Canning Handbook on Plating in 1925, and since that date it has grown apace and is still increasing in volume and widening its field of application. The book is profusely illustrated and shows the apparatus used and the processes involved.

New Electricity Showrooms at Sheffield

New showrooms in Mappin Buildings, Sheffield, which will be used for demonstration and other purposes for a few years until the large building is erected in Fargate, were recently officially opened for the Sheffield Corporation Electricity Department by the Deputy Lord Mayor of Sheffield (Coun. Mrs. A. E. Longden). Others present included Ald. J. A. Longden, chairman of the Corporation Electricity Committee (who presided), Mr. J. R. Struthers (general manager and engineer), and Mr. A. C. Bostel (consumers and sales engineer). Mrs. Longden said that the showrooms marked a step forward in the progress and development of the city's electricity undertaking. The report presented by the chairman of the Electricity Committee at the last Council meeting was one with which everybody concerned must be proud. However, something more than cheap electricity was needed. It was necessary to put before the public the means and the methods whereby electricity could be used to the best advantage, and that could only be done by having good showrooms, where they could demonstrate how cheaply and efficiently a home could be run with electricity. Ald. Longden said that in the autumn, extensions to the power station would be completed. He paid tribute to the work of Mr. Struthers.

The new showrooms, centrally situated, have a spacious front reception showroom for the display of equipment, and behind this are the inquiry offices. A stairway is designed to appear like that in a normal home, and the adjoining demonstration hall has a seating capacity of about 200, with an ample demonstration stage in the rear. There is access from this hall to a model kitchen and a model bathroom, attractively decorated.

Electric Cooking at a Fair

A modern and somewhat unusual feature of South Molton's "Old English Fayre" this year was the use of a Creda electric cooker at a "hot dog" stall. The cooker, which was lent for the occasion by the Exe Valley Electricity Co., was set up in the open street and it proved quite equal to the large demand for "hot dogs" among the fair-goers. The picture shows the cooker surrounded by helpers at the fair.

A Creda electric cooker in use at the South Molton "Old English Fayre"

Carron Company's History

The Carron Company first commenced operations in 1759. Cannon which it made were used on the *Victory* and other

British ships-of-war, while Carron field guns were used in the Peninsular war and in other campaigns. The company's products, however, are perhaps better known in the industrial sphere and in the home, where the modern housewife finds "Carron" stamped on her coal, gas or electric fires. The early days presented many difficulties in transport and to meet the need for safe, reliable transport the company acquired sea-going vessels. The first complete set of castings for James Watt's steam engine were made at Carron, where in 1789, under the direction of William Lymington, were built the engines for the first steamship made in the United Kingdom. These and many more interesting facts are recorded in "Carron Company, from the Reign of George II to the Reign of George VI, 1759-1938," while details are also given of the many present-day activities of the company. Well-produced illustrations increase the interest of the contents.

United States Electrical Machinery Exports

The exports of electrical machinery and allied material from the United States during the six months ended with June last attained a value of £51,360,000 as compared with £45,260,000 in the corresponding half of 1937, an increase of 13.5 per cent.

Wages in the Cable-making Industry

The Joint Industrial Council for the Electrical Cable Making Industry announces that the August 2nd cost-of-living figure (56 per cent. above the 1914 level) will not involve any alteration in wages on the third pay-day in September.

Dutch Electrical Imports and Exports

The following tables show the Dutch imports and exports of electrical machinery and applied material during the first six months of 1937 and 1938. The sterling value of the totals converted at 9 guilders to the £ has been added :—

IMPORTS.

Classification		January to June.			
		1937.		1938.	
		Quantity.	Value in 1,000 guilders.	Quantity.	Value in 1,000 guilders.
Electric generators and parts	tons	325	480	526	693
Electric motors and parts	,,	834	962	1,245	1,631
Radio sets and parts	,,	1,519	4,374	1,166	3,461
Telegraph and telephone material	,,	1,615	2,384	1,527	3,141
Elec. vac. cleaners and parts	,,	182	455	173	521
Elec. measuring instruments and other apparatus	,,	3,206	4,768	3,022	4,889
Elec. wires and cables	,,	3,722	1,609	7,582	2,594
Elec. lamps over 16 V.	No.	480,500	176	379,900	175
Elec. lamps under 16 V.	,,	376,000	44	887,400	64
Other electric lamps		—	15	—	37
Cycle lighting dynamos	No.	44,042	76	37,343	72
Cycle lighting dynamo parts		—	31	—	54
Cycle electric bulbs	No.	205,719	496	166,699	467
Bulbs for electric lamps	tons	79	49	161	109
Elec. and other refrigerating machines	No.	1,749	240	2,434	314
Total guilders		—	16,159,006	—	18,222,000
Total at 9 guilders to £		—	£1,795,445	—	£2,024,667

EXPORTS.

Classification	January to June.			
	1937.		1938.	
	Quantity.	Value in 1,000 guilders.	Quantity.	Value in 1,000 guilders.
Electric generators and parts	220	198	236	247
Electric motors and parts	557	570	620	807
Radio sets and parts	4,563	21,447	3,099	18,384
Telegraph and telephone material	27	163	57	176
Elec. vac. cleaners and parts	57	106	101	193
Elec. measuring instruments and other apparatus	958	1,695	1,408	2,816
Elec. wires and cables	3,605	1,656	4,992	2,152
Elec. lamps over 16 V.	7,438,200	2,764	6,338,600	2,437
Elec. lamps under 16 V.	4,851,700	876	4,068,000	724
Other electric lamps	—	396	—	681
Cycle lighting dynamos	11,636	19	58,767	152
Cycle lighting dynamo parts	—	2	—	18
Cycle electric bulbs	13,734	46	23,449	71
Bulbs for electric lamps	725	676	742	700
Elec. and other refrigerating machines	13	3	39	4
Total guilders	—	30,617,000	—	29,562,000
Total at 9 guilders to £	—	£3,401,899	—	£3,284,667

Electricity Consumers' Booklet

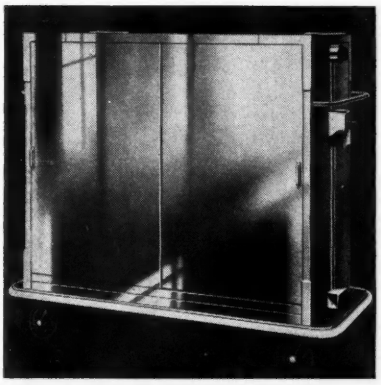
We have received from the West of England Electric Investments, Ltd., a new booklet dealing with the hire of cookers, water heaters and refrigerators which has been produced for the use of its associated companies operating in Devon and Somerset. The illustrations have been selected from actual installations which its companies have carried out recently, and include some typical examples of West of England homes and kitchens. The value of this form of propaganda is increased by extracts from consumers' letters.

A Supply Company's Showrooms at Falmouth

New showrooms and offices were opened recently at Church Street, Falmouth, by the Electric Supply Corporation, Ltd. The showrooms run the full depth of the building and from the rear a fine view of the harbour is obtained. The main showroom has an attractive selection of lighting fittings, electric fires, &c., while a separate room has been arranged as a model kitchen where lectures and demonstrations will be given. During the visit of inspection Mr. A. Howden, the local manager of the company, mentioned that the E.A.W. was forming a branch at Falmouth, with Mrs. Colthurst as area officer. At the company's works at the Beacon two new destructors were being fitted under the boilers and two new alternators were being installed in place of the old d.c. generators, to generate electricity from the destruction of the town's refuse.

Electrical Equipment for Holiday Camps

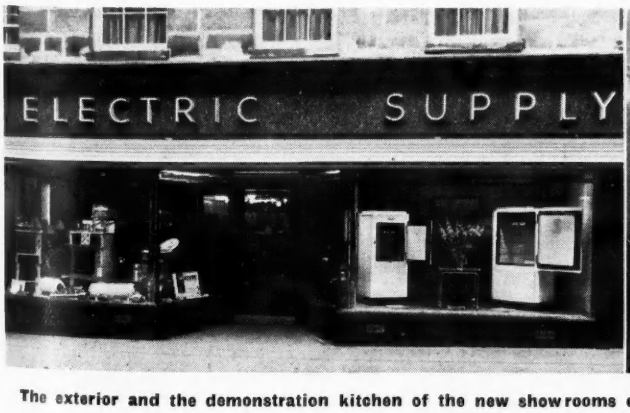
Quick and efficient service of the cooked food from the kitchens to the large dining rooms is one of the most important links in catering for the many thousands of people at Butlin's holiday camps. For this service the Jackson Electric Stove Co., Ltd., supplied twenty-five electrically heated food trolleys for the two camps and one of the trolleys is shown in the accompanying picture. They are constructed of aluminium and Birma Bright, efficiently insulated throughout to ensure retention of heat during service and are provided with two sliding doors on each side of the trolley. There are sixty compartments per side providing accommodation for 120 courses in each trolley. The heating of each is controlled by its own thermostat, thereby ensuring the correct heat for the various types of food. Guiding rails are fitted at both ends, and the trolley is mounted on 6 in. diameter rubber tyred wheels—two castor and two fixed wheels—to ensure easy steering. The heating elements in a separate compartment at the bottom of the trolley are loaded to 2 kW. A buffer rail is mounted on each completely protecting the trolley from damage when passing through swing doors, &c. The overall dimensions are approximately 5 ft. long by 2 ft. 3¼ in. wide by 4ft. 4 in. high including wheels. The company has also supplied to the two camps large electric cooking ranges and electric fish frying equipment.



A Jackson electrically heated food trolley supplied to a holiday camp

The British Foundry School

The fourth session of the British Foundry School will open on September 20th. The entries for the coming session are already in excess of those for each of the past two years and

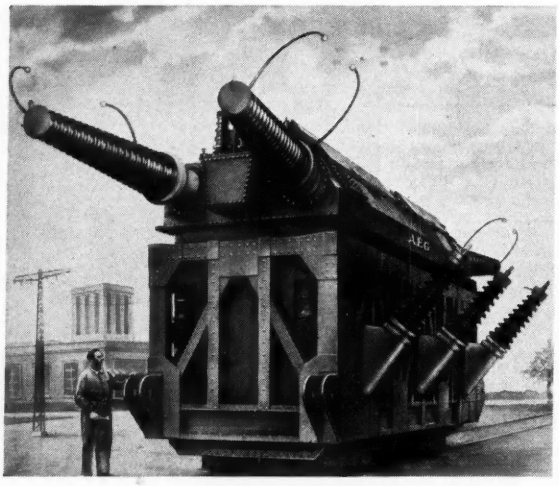


The exterior and the demonstration kitchen of the new showrooms of the Electric Supply Corporation, Ltd., at Falmouth

full information will be supplied by the secretary of the school at the Central Technical College, Birmingham. A number of foundries have begun to adopt the practice of offering suitably educated young men a foundry apprenticeship of two to three years, the final year of which is spent at the school.

A Large Mobile Transformer

A 120,000-kVA transformer which can be moved rapidly to any desired spot has recently been constructed in Germany.



A large mobile transformer which has recently been constructed in Germany

On arrival at its destination it can be put into commission within a few hours. It is claimed to be the largest unit of its kind in the world and is wound for 220-110-10 kV.

An Electro-horticultural Conference

Arrangements have been made by the Manchester Corporation Electricity Department for a conference on electro-horticultural appliances to be held on September 13th in the lecture hall of the municipal electricity showrooms. The principal speaker will be Mr. A. Monkhouse. Another forthcoming engagement is a water heating conference for October 28th. Electrical contractors will be invited to this meeting.

A Large Carillon

A demonstration was given last Monday at Gillett & Johnston's bell foundry, Croydon, of a carillon of forty-four bells which is shortly to be shipped for installation in the 400-ft. "Tower of the Sun" of the Golden Gate International Exhibition. At the close of the exhibition the carillon will be moved to Grace Cathedral, San Francisco. The total weight of the bells only is over 18 tons, the complete installation weighing 34 tons. The carillon is to be played by remote control from an ivory keyboard at the organ console when it is erected finally at Grace Cathedral. There will also be an arrangement for playing any desired tunes automatically.

German Electrical Imports and Exports

The imports of electrical machinery and allied material into Germany during the six months ended with June last are officially returned at 9,564,000 Rm. (about £783,935 at the current rate of exchange) as compared with 8,344,000 Rm. (£683,935) during the corresponding half of 1937. During the same period the exports of similar material from Germany increased in value from 139,060,000 Rm. (£11,365,575) to 160,501,000 Rm. (£13,155,820).

The International Building Club

The International Building Club has acquired premises at 141, Park Lane, London, W., which will be officially opened on October 10th. The purpose of the club is mainly social, and membership is open to all who are associated with the building industry. Particulars can be obtained on application to the secretary, Mr. L. J. F. Lawler, 35, Basildon Court, Devonshire Street, W.1.

Appointments Vacant

Chief engineer to the Turf Development Board, Ltd., Dublin.

Engineer for Post and Telegraph Department of Malaya.

Electrical and mechanical engineer for War Department Station, Aborfield Cross, nr. Reading.

Electrical fitter for Barrow-in-Furness Electricity Department.

(See our classified advertisements.)

The Heating of Factories

Under the Factories Act which recently came into force, a minimum temperature of 60 deg. is required in workshops. A booklet issued by Benham & Sons, Ltd., entitled "Heating Fixtures for the Season," should prove useful to those contemplating the installation of heating apparatus in workshops and factories. This booklet includes a pocket containing leaflets dealing with electric heating appliances for commercial and domestic purposes which conform with the Act. Among these are "Electro-vapour" and "Electronic" radiators and "Convectum-Air" heaters.

Trade Announcements

The Northern Steel & Hardware Co., Ltd., has appointed as its representatives in the Isle of Man the Isle of Man Electrical & Hardware Distributors, 40a, Parliament Street, Ramsey (Telephone: Ramsey 2177), who will be carrying, at the warehouse in Tower Street, large stocks of electrical equipment, including switches, switchgear, lamps and cables, and B.V.A. valves.

It is announced that Mr. H. Vic Verrells, export manager of E. K. Cole, Ltd., has appointed agents in France for "Ekco" testing and measuring equipment. The agents, the Leyland Radio Import Co., of 6, Rue Marbeuf, Champs Elysees, Paris (8e), will be in charge of the distribution and marketing of these products in that country.

With reference to the announcement regarding the acquisition by E. K. Cole, Ltd., of the exclusive rights to manufacture and distribute the products of the Coffield Washer Co., Ltd., we are asked by the British Electric Domestic Appliances (1938), Ltd., to state that this arrangement does not in any way affect the "Bedal" or "Astoria" washers, which the British Electric Domestic Appliances (1938), Ltd., will continue to market, nor the "Mary Ann" or "Bedalax" cleaners which have always and will continue to be produced and marketed by that company.

Advertisement Correction

The telegraphic address of the Fuller Electrical and Manufacturing Co., Ltd., is Fullmage, Telex, London, and not Fullmage, Walt, London, as shown in our advertisement pages.

Prices of Materials

The following prices are only general, and they may vary according to quantities and other circumstances:—

CHEMICALS, ETC.	Price August 24th.	Fortnight's Inc. or dec.
a Acid Oxalic ... ... per cwt.	50s.	—
a Ammoniac, Sal ... ... per ton	£37	£1 inc.
a Ammonia, Muriate (large crystal)... ,,	£18 10s.	—
a Borax... ... ... ,,	£17	—
a Copper, Sulphate ... ... ,,	£19	£3 10s. dec.
a Potash, Chlorate ... ... per lb.	3¾d. to 4¼d.	—
a ,, Perchlorate... ... ... ,,	6d.	—
a Shellac ... ... per cwt.	£4 8s.	10s dec.
a Sulphur, Commercial ... ... per ton	£11	—
a ,, Roll ... ... ,,	£11	—
a Soda, Chlorate ... ... per lb.	3¼d. to 3½d.	—
a ,, Crystals ... ... per ton	£5 to £5 5s.	—
a Sodium, Bichromate, casks ... per lb.	4¼d. net.	¼d. inc.
METALS, ETC.		
b Aluminium, Ingots ... ... per ton	£94 to £99	—
b ,, Wire ... ... per lb.	1/1 to 1/9	—
b ,, Sheet and Foil ... ,,	1/3 to 2/9	—
p Babbits Metal and Anti-friction Metals—		
Grade I ... ... per ton net	£181	£3 dec.
Grade II ... ... ,,	£127	£2 dec.
Grade III ... ... ,,	£70	£1 dec.
c Brass (rolled metal 2" to 12" basis)... per lb.	7⅛d.	⅛d. dec.
c ,, Tubes (solid drawn) ... ... ,,	11⅛d. to 11⅜d.	—
c ,, Wire, basis ... ... ,,	8¼d.	⅛ddec.
c Copper Tubes (solid drawn) ... ,,	1/0½d.	½d inc.
g ,, Bars (best selected) ... per ton	£76	£2 dec.
g ,, Sheet... ... ... ,,		
g ,, Rod ... ... ,,		
d ,, (Electrolytic) Bars... ... ,,	£46	£1 15s. dec.
d ,, ,, Wire Rods ... ,,	£50 15s.	£1 15s. dec.
d ,, ,, H.C. Wire ... per lb.	7⅛d.	⅛ dec.
f Ebonite Rod ¼" dia. & up.... ... ,,	1/10 to 2/5	—
f ,, Sheet ¼" thick & up ... ,,	1/5 to 1/10	—
n German Silver Wire, Nos. 1 to 12 ... ,,	2/4	—
h Gutta-percha, fine ... ... ,,	nom.	—
h India-rubber, Para-fine ... ... ,,	7¾d.	¼d. inc.
i Iron, Pig (Cleveland, No. 3) ... per ton	£4 5s.	—
i ,, Wire galv. No. 1 P.O. Qual.... ,,	£23	—
g Lead, English Pig ... ... ,,	£16 10s.	—
g Mercury ... ... per bot.	£13 10s.	—
e Mica (in orignal cases) small ... per lb.	10d. to 2/-	—
e ,, ,, ,, medium ... ,,	6/- to 12/6	—
e ,, ,, ,, large ... ,,	13/- to 17/6 up	—
p Phosphor Bronze, plain castings ... ,,	1/2¼	—
p ,, ,, drawn bars & rods ,,	1/0¼d.	—
p ,, ,, rolled strip & sheet ,,	11d.	—
p ,, ,, wire ... ... ,,	1s. 1d.	—
o Platinum ... ... per oz.	£8	15s. inc.
d Silicium Bronze Wire ... ... per lb.	8¾d.	⅛d. dec.
g Spelter ... ... per ton	£13	18s. 9d. dec.
g Tin, Block (English) ... ... ,,	£190 10s.	£3 10s. dec.
n ,, Wire, Nos. 1 to 16 ... ... per lb.	3/6	—

Quotations supplied by:—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India Rubber, Gutta Percha and Telegraph Works Co., Ltd.
g Henry Gardner & Co., Ltd.
h Edward Till & Co.
i Bolling & Lowe.
n P. Ormiston & Sons.
o Johnson Matthey & Co.
p C. Clifford & Sons, Ltd.

The above table is published here fortnightly. In alternate issues, in which it does not appear, the latest prices of copper, silicium bronze wire, lead, rubber, tin and spelter, up to the time of going to press, are given in our "Business Notes" under the same heading.

New E.C.A. Members

At a recent meeting of the E.C.A. Council a number of applications for membership were considered and the following contractors were admitted to full membership :—

Charlton Electric Co., Ltd., 262/3, Empire House, St. Martin's-Le-Grand, E.C.1; A. H. Cornwall, Ltd., 42, Bruton Place, W.1; Strand Electric & Eng. Co., Ltd., 24, Floral Street, Covent Garden, W.C.2; John Richards & Co. (London), Ltd., 23, St. Mary Axe, E.C.3; C. W. Barker & Co., Felixstowe; W. D. Goodenough, Redland, Bristol; H. J. Sanders & Son, Minehead; M. J. Wagg & Sons, Bristol; Gwilliam Bros., Stourbridge; H. A. Roebuck, Baslow, Derbyshire; S. G. Meikle, St. Anthony's, Newcastle-on-Tyne; J. W. Potts, Newsham, Blyth, Northumberland; William Lee, Atherton, Lancs.

The following contractors were admitted to associate membership :—

W. Dunkerley & Co., Ltd., Chipping Sodbury, Glos; James Priddy, Weston-Super-Mare; Lionel F. Saunders, Bristol, 7; Tily Bros., Chipping Sodbury, Glos; V. F. Cannon, Teignmouth; J. A. Earnshaw, Halifax; Arthur Smith, Sutton-in-Craven; Cocks & Catterall, Preston.

Business Administration

The London School of Economics and Political Science (University of London) has issued the prospectus of the Department of Business Administration for 1938-39. Application forms for admission (returnable by September 12th) can be obtained from the Registrar, Houghton Street, Aldwych, W.C.2.

For Sale

Bolton Corporation has for disposal two 1,000-kW rotary convertors. (See our classified advertisements.)

French Electrical Imports and Exports

The French imports and exports of electrical machinery, apparatus and cognate material during 1937 as compared with the preceding twelve months are shown in the following table. The values are given in thousands of fr. while the sterling value of the totals converted at the current franc value of 178 to the £ has been added. It will be seen that the past year's imports show an increase of no less than £756,460 and the exports one of £504,922.

	Imports.		Exports.	
	1936.	1937.	1936.	1937.
	1,000 Fr.		1,000 Fr.	
Dynamo-electric machines, transformers and parts	28,451	52,042	21,131	32,527
Telegraphic, telephonic and other elec. apparatus	135,695	193,537	71,970	97,959
Incandescent lamps and radio valves	46,959	77,510	14,425	20,126
Arc lamps and parts	169	392	27	62
Carbons for electrical and industrial purposes	5,041	8,771	10,358	23,796
Electric wires and cables ...	5,950	10,685	30,310	45,987
Parts of electrical apparatus ...	16,824	26,398		
Magnets, other than electro-magnets	747	951	11,700	18,865
Accumulators and parts... ...	1,583	2,092	9,971	15,225
Dry batteries and condensers ...	12,358	14,898	2,489	4,258
Porcelain and other insulators ...	1,638	2,789	8,447	11,899
Total	255,415	390,065	180,828	270,704
Total at 178¼ Fr. to £ ...	£1,434,917	£2,191,377	£1,015,888	£1,520,810

New Catalogues and Lists

Bulpitt & Sons, Ltd., Swansea Works, Camden Road, Birmingham.—A leaflet illustrating "Swan" fires.

J. H. Tucker & Co., Ltd., King's Road, Tyseley, Birmingham.—A folder dealing with a.c. slow-break units.

Sturtevant Engineering Co., Ltd., 147, Queen Victoria Street, London, E.C.4.—A catalogue of air washers.

J. Howden & Co., Ltd., Caxton House, London, S.W.1.—A booklet detailing and illustrating plant supplied to the Fulham power station.

Wm. Sanders & Co., Ltd., Falcon Electrical Works, Wednesbury.—A catalogue of "Super-Sandaspeed" fuses.

Lighting Trades, Ltd., 55, Garratt Lane, London, S.W.18.—A complete catalogue of shades and bowls for electric lighting.

A. Reyrolle & Co., Ltd., Hebburn-on-Tyne.—A reprint of a paper entitled "Automatic and Rapid Isolation of Faults in Supply Systems."

Dowsing Co. (Electrical Manufacturers), Ltd., Kangley Bridge Road, Lower Sydenham, London, S.E.26.—A leaflet listing a range of domestic appliances.

Falk, Stadelmann & Co., Ltd., 83/93, Farringdon Road, London, E.C.1.—A complete catalogue (pp. 52) of electrical appliances for the home.

Marconi-Ekco Instruments, Ltd., Electra House, Victoria Embankment, London, W.C.2.—A comprehensive catalogue, bound in a stiff cover, dealing with laboratory standards, audio-frequency and radio-frequency instruments, and production test equipment.

Hackbridge Electric Construction Co., Ltd., Walton-on-Thames.—Publication No. D.B.22, describing arc suppression coils (Petersen coils).

Allen West & Co., Ltd., Brighton, 7.—Particulars of type "OB" switchgear which has been tested by the British Short-Circuit Testing Station, Ltd., Hebburn-on-Tyne, and found to meet the requirements of British Standard Specification 156-1937.

S. Rawlinson, Ltd., Blackburn.—A broadsheet illustrating some of the counter-balanced tower wagons made by the company, and also giving a list of recent deliveries.

Goodliffe Electric Co., Ltd., Goodtric Works, Purley Way, Croydon.—List O.L.8, giving particulars and prices of "Goodtric" telegraph and linesmen's tools.

J. Toubkin, Faraday House, Todd Street, Manchester, 3.—An illustrated catalogue of domestic electrical appliances, including a number of lines which are new to the market.

Private Arrangements

F. T. Bourbery & Sons, Ltd., 342-348, Uxbridge Road, Shepherds Bush, London, W.12, radio and electrical engineers.—An informal meeting of the principal creditors was held recently, when the statement of affairs showed ranking liabilities of £1,544. The net assets were £969, leaving a deficiency of £575. It was reported that certain creditors had commenced proceedings and it was generally agreed by the meeting that the company should go into voluntary liquidation. The directors, it was stated, would follow that course.

G. T. S. Marsh, trading as Modern Electric Clock Co., 630, London Road, Westcliff-on-Sea.—The creditors were called together recently at the offices of Mr. C. Latham, accountant, 185/188, High Holborn, London, W.C., when the statement of affairs showed ranking liabilities of £948. The net assets were £256, leaving a deficiency of £692. It was decided that the matter should be dealt with under a deed of assignment to Mr. Latham, with a committee consisting of the representatives of Siemens Schuckert (G.B.), Ltd., Ismay Distributors, Ltd., and Burton Miller & Son.

Receivers Released and Appointed

Superfluxes, Ltd. (old company).—R. H. Stevens, of 37, Walbrook, E.C., ceased to act as receiver and manager on July 19th, 1938.

Associated P.A. Equipments, Ltd.—E. M. B. Gordon, of 36, King Street, E.C. was appointed receiver on August 10th, 1938, under powers contained in first mortgage debenture dated June 17th, 1938.

Bankruptcy Proceedings

J. J. Eastick & Sons (a firm), carrying on business at Eelex House, 118, Bunhill Row, E.C., wireless factors.—The first meeting of creditors was held on August 17th at London Bankruptcy Buildings, Mr. C. T. Newman, Assistant Official Receiver, presiding. Mr. Newman said that no statement of affairs had yet been sworn, but a large number of proofs of debts had been received. It was further stated that a composition would be offered to the creditors and as that would have to be considered the meeting was adjourned for three weeks.

J. B. Clements, 85, Church Street, Tewkesbury, radio and electrical engineer.—At the public examination held on August 18th at the Court House, Cheltenham, the statement of affairs disclosed ranking liabilities of £396, leaving a deficiency of £246. Debtor attributed his present position to lack of commencing capital, insufficient trade, and illness. The examination was closed.

C. H. Chadwick, Mill Road, Cromer, wireless dealer.—The first meeting of creditors was held on August 16th at the Official Receiver's Office, Castle Chambers, Opie Street, Norwich, when a statement of affairs was submitted showing gross liabilities of £1,192, of which £433 was expected to rank for dividend, and there were net assets of £171, leaving a deficiency of £262. The case being a summary one was left in the hands of the Official Receiver as trustee.

A. W. Sadler, radio engineer and dealer, 115, Osmaston Road, Derby.—Receiving order made August 17th on debtor's own petition.

J. T. Townson, radio and electrical engineer, 97, Market Street, Dalton-in-Furness.—Public examination September 23rd at the Magistrates' Court, Barrow-in-Furness.

J. R. Brightwell, electrical contractor, 107, Queen's Road, W.2.—Trustee, Mr. P. Phillips, 14, Langham Street, Portland Place, W.1, released July 27th.

H. W. Langford (A. Pritchard & Co.), electrical and automobile engineer, High Street, Lye.—Trustee, Mr. F. E. Bendall, Midland Chambers, Warwick Passage, Corporation Street, Birmingham, released July 15th.

J. T. Southwood, electrical engineer, 13, Brandreath Road, Compton, Plymouth, lately trading at Belgrave Garage, Mutley, Plymouth.—Last day for receiving proofs for dividend September 3rd. Trustee, Mr. A. N. F. Goodman, 11, St. Aubyn Street, Devonport, Plymouth.

H. L. A. Wines, radio engineer, King Street, Yeovil.—Last day for receiving proofs for dividend September 2nd. Trustee, Mr. H. T. Jones, 12, Rolleston Street, Salisbury, Official Receiver.

R. W. Burrows (Radio Services), radio and electrical engineer, High Street, Skegness.—First and final dividend of 3d. in the £, payable August 22nd at the Official Receiver's office, 1, St. Swithin's Square, Lincoln.

R. Corbett and **I. A. J. Merritt** (Corbett and Merritt), electrical and radio engineers, 2b, Junction Road, Andover.—First and final dividend of 15s. 0½d. in the £, payable August 22nd at 12, Rolleston Street, Salisbury.

Company Liquidations

Gambrell Radio Communications, Ltd., Broomhill Road, S.W.18, wireless engineers.—The first meetings of creditors and shareholders were held on August 17th at London Bankruptcy Buildings, when Mr. E. T. Sanders, Assistant Official Receiver, presided. Mr. Sanders said that the statement of affairs filed showed, as at April 7th last, assets estimated to produce £104,917 against gross liabilities of £213,091. The latter included unsecured trade creditors' claims of £17,129, loans on debenture totalling £169,470, and other liabilities of £23,350. The failure was attributed to lack of supervision and insufficient capital. The liquidation was left in the hands of the Official Receiver.

Johnson & Foster, Ltd.—Winding up voluntarily. Liquidator, Mr. B. Spooner, Barclays Bank Chambers, Silver Street, Gainsborough.

Permastic, Ltd.—Winding up voluntarily. Liquidator, Mr. J. Cooper, 567-9, Fulham Road, S.W.6.

Cramill Electric Co., Ltd.—Particulars of claims by September 2nd to the liquidator, Mr. J. R. Atkins, 14, St. Ann's Square, Manchester, 2. Meeting at St. Ann's Square on September 23rd to receive an account of the winding-up by the liquidator.

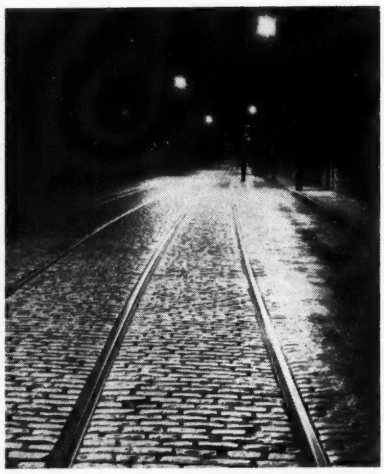
Electricity Supply

Lighting, Domestic, Power

Aberdeen.—LIGHTING AN ART GALLERY.—The lighting of Aberdeen Art Gallery is to be improved at a cost of £1,000.

Aldeburgh.—SUBMARINE CABLE LAID.—At high tide last Friday morning W. T. Henley's Telegraph Works Co., Ltd., laid a high-voltage submarine cable across the River Alde to provide the last link of an 11-kV ring main, connecting with the Ipswich power station the northern and southern sections of the distribution system of the East Suffolk Electricity Distribution Co., Ltd. The cable was brought from Ipswich in one length mounted on a drum, a barge being the means of transport down the Orwell and up the Alde. The engineers were Messrs. B. V. Langfield and T. W. Middlemiss.

Bingley.—FLUORESCENT DISCHARGE LIGHTING.—A new main road lighting scheme comprising 150 fluorescent electric discharge lamps was inaugurated last week by Mr. E. R. Pack, chairman of the Urban District Council. Staggered 40 ft. apart on each side of the road, the lamps extend for a distance of three miles, and a further thirty-seven units are to be added to the installation shortly. The apparatus was supplied by the Wardle Engineering Co., Ltd., and the Metropolitan-Vickers Electrical Co., Ltd., Standard Telephones & Cables, Ltd., being responsible for the remote control gear and relays for switching on from a single control point at the electricity works. The whole of the erection work has been carried out by the Electricity Department's staff to the specification of the Council's chief electrical engineer and manager, Mr. O. G. Cook, who was complimented on the installation by Mr. W. B. Woodhouse, managing director of the Yorkshire Electric Power Co., and Councillor A. R. Bentley, chairman of the Lighting and Tramways Committee, at a supper held after the switching-on ceremony.



The new fluorescent street lighting at Bingley

Buckingham.—NO SUPPLY FOR BEACHAMPTON.—At a recent meeting of the Rural District Council a letter was read from the Northampton Electric Light & Power Co. stating that the demand would not justify an extension to Beachampton.

Cardiff.—ELECTRICITY REPLACES GAS.—The Great Western Railway Co. is to replace the existing gas lighting in East Wharf Road, Cardiff Docks, by electricity.

Chatteris.—OVERHEAD LINES REFUSED.—The Urban District Council has refused permission to the Beds, Cambs and Hunts Electricity Co., Ltd., to erect overhead lines in certain streets.

Clitheroe.—CHEAPER ELECTRICITY.—A general reduction of electricity charges will represent a concession of £1,300 to consumers. This lowering of tariffs is made in spite of an increase of 30 per cent. in the cost of coal and in spite of the fact that the electricity undertaking is faced with a further £1,000 increase in coal charges during the current year.

LOAN SANCTIONED.—The Town Council has received sanction to the borrowing of £750 for works and equipment for supplying electricity to Waddow Hall and premises between Sawley and Gisburn.

Eire.—A PEAT-OPERATED POWER STATION.—In conjunction with the bog reclamation scheme now being carried out by the Turf Development Board, a peat-driven generating station is to be established by the Electricity Supply Board at Clonsast, near Portarlington. The Turf Board, it is stated, will be required to provide about two hundred thousand tons of prepared fuel yearly for the new station, which will be capable of an output equal to at least half of that to be generated at Poulaphouca, where a large hydro-electric scheme is now in course of construction. The E.S.B.'s new scheme, which will be followed up by larger developments, was decided upon after a detailed examination of Continental methods of peat-fuel production and peat-driven generation station experiments.

France.—NEW POWER STATION.—The Compagnie Nationale du Rhône, of Lyons, has secured a concession to utilise the Genissiat Falls on the River Rhône between the Swiss frontier and the Genissiat Chateau. The power station, which will work under a head of about 120 ft., will be initially equipped with two 150,000-kW turbo-generators.

Glasgow.—SUPPLY TO FARMS.—The Health Committee is to install electricity at the East and West Muckcroft Farms at an estimated cost of £620.

FIRE ALARM SYSTEM.—An electric fire alarm is to be installed at Belvedere Hospital at a cost of £1,020.

Holyhead.—STREET LIGHTING IMPROVEMENTS.—The Urban District Council is to improve street lighting at an estimated cost of £1,400.

India.—ELECTRICAL RESOURCES OF BENGAL.—The Government of Bengal is proposing to undertake a survey of the electrical resources in the province, with a view to ascertaining the possibility of utilising electric power in the development of small industries. The electrical adviser to the Government has been entrusted with a preliminary inquiry into the matter.

Lanark.—E.H.V. CABLE.—The Clyde Valley Electrical Power Co. is to lay an extra-high-voltage cable from the sub-station at Stoneyetts to supply a housing scheme at Bridgend.

Largs.—ILLUMINATIONS.—The municipal illuminations, the equipment of which cost £7,000, are now attracting much attention. Two miles of fairy lights encircle the sea front, and the usual floodlighting features are in operation.

Macclesfield.—PROPOSED ACQUISITION OF UNDERTAKING.—Last week the Corporation served the official notice on the Electricity Co. of Macclesfield, Ltd., that it will require the company to sell that part of the undertaking authorised by the Macclesfield Electric Lighting Order, 1911.

Middlesbrough.—LOANS.—The Town Council is applying for sanction to borrow £2,429 for the purchase of nine circuit breakers. Application is also being made for sanction to loans of £1,557 for transformer and other equipment for a new sub-station and £1,226 for equipment for the Roman Road (Kirby School) sub-station.

ELECTRIC LIFT.—A lift is to be installed in the Borough Engineer's Department at a cost of £600.

Poland.—ELECTRICITY SUPPLY PROGRESS.—According to a recent Polish Government report, the number of electric power stations in Poland increased from 2,561 in 1934 to 2,792 at the close of 1936, their total installed capacity advancing from 1,536,000 to 1,580,000 kW. The bulk of the plants are of small capacity, there being only 193 with generating equipment exceeding 1,000 kW.

Pontardawe.—BULK SUPPLY CHARGES.—Mr. R. M. Jenkins, the Rural District Council electrical engineer, reported last week that he had interviewed representatives of the South Wales Power Company, the Neath Rural District Council, and the Electricity Commissioners with regard to the charges to be made for bulk supplies upon the termination of the Council's agreement with the South Wales Power Company. The Council was informed that should they accept the charges offered by Neath Council it would be necessary to construct a high-tension line from Pontardawe to Neath, and that in any case in 1940 the generating station at Tir John, Swansea, would become a selected station. In that case, if the Council was receiving a supply from Swansea, it would be entitled to the cost of generating, together with transmission and capital charges.

Rugby.—EXTENSIONS.—Supplies of electricity are to be given to Rokeby Estate and to the Avon waterworks.

NEW SWITCHGEAR.—New 12-kV switchgear is to be installed at the Barby road sub-station, Rugby.

Scilly Isles.—ELECTRIFICATION OF TRESCO.—The complete electrification of Tresco is being carried out at present by the Plymouth engineering firm of W. G. Heath & Co., which also counts among its current activities three electrification schemes in rural districts in Devon.

Southend-on-Sea.—HEATING OF TOWN HALL.—The Town Hall Committee is to be asked to afford an opportunity to the borough electrical engineer to submit a scheme for heating the proposed new Town Hall by electricity.

Southport.—A LARGE NEW CONSUMER.—The Brockhouse Engineering Co. (Southport), Ltd., has made arrangements for the Corporation to provide electricity to the Vulcan Works, Crossens, instead of generating its own supplies. The company will be the Corporation's largest individual consumer of electricity.

Sunderland.—BETTER STREET LIGHTING.—The Town Council is to improve the street lighting in Coronation Street and High Street (cost £523), Plains Farm—Outer Ring Road (£805), and Laura Street and Toward Road (£92).

Torquay.—MAINS AND SERVICES.—The Corporation Electricity Committee is applying for sanction to borrow £30,000 for mains and services.

ELECTRICITY CHARGES ON HOUSING ESTATE.—The charges for electricity paid by tenants on the Corporation's various housing estates under the limiter system are to be increased from 1s. to 1s. 1½d. per week, the equivalent of the 12½ per cent. increase recently made in the tariff.

Weymouth.—SUPPLY TO BINCOMBE.—Following requests from tenants and landowners the electrical engineer is to prepare a report regarding the supply of electricity to Bincombe.

EXTENSIONS.—The Electricity Committee is to extend mains at a cost of £185 to the Neath estate, Preston, and has obtained sanction to borrow £605 for sub-stations and £3,900 for mains in connection with the supply to Bowleaze and Southlands.

SUB-STATIONS.—The Electricity Committee has obtained a site in Queen Street for the erection of a sub-station.

Whitby.—OVERHEAD LINES.—Approval has been given to plans for overhead cables submitted by the North-Eastern Electric Supply Co., Ltd., to supply electricity to houses at Staithes. Overhead lines extensions are also proposed by the supply company at Glaisdale.

York.—PROPOSED DEVELOPMENTS.—A scheme of electrical developments during the next five years will cost £392,000.

Traction

Great Western Railway.—STATION IMPROVEMENTS.—Improvements are to be carried out to the main booking office and booking hall at Slough to cater for the volume of traffic which has increased by 60 per cent. since 1933. Synchronised electric clocks are to be installed throughout the station. At Blowers Green new station buildings are to be constructed in a more convenient position at the opposite end of the station facing on to New Road.

Manchester.—TRAMS TO BE SCRAPPED?—The most important subject to be discussed at the City Council's meeting next month is a proposal to scrap all the trams within the next three years and substitute motor buses on all routes except four, which would have trolley-buses. The scheme would result in a big reduction in the municipality's consumption of its own electricity, and the total estimated cost of conversion is £875,280, including £665,600 for motor buses and £220,220 for trolley-buses. The Transport Committee last Tuesday approved a report on the question submitted by the general manager of the Transport Department, Mr. R. Stuart Pilcher. The scheme would require 337 more motor buses and 91 extra trolley-buses. Mr. Pilcher appreciates the need for cheap fares to meet the demands of new housing estates away from the city centre, but he says that present fares cannot continue if the cost of operation per mile run were to be increased on a major section of the undertaking. He considers it desirable, if possible, for the streets to be freed from overhead equipment. It is estimated that reinstatement of roadways, by the adoption of a three-years' plan, would cost the Transport Committee £197,320, whereas tram-track renewal would cost £924,194.

New Zealand.—WELLINGTON-JOHNSONVILLE ELECTRIFICATION SCHEME.—Electric multiple-unit trains, the first of their kind in New Zealand, were recently put into regular service on the Wellington-Johnsonville line. The *New Zealand Electrical Journal* states that the completion of the electrification of this line marks the first step in an extensive electrification programme in the vicinity of Wellington. Though only a suburban line of approximately 6½ miles, serving the suburbs of Ngaio, Khandallah and Johnsonville, it is the forerunner of a larger scheme, now well under way, namely, the Wellington-Paekakariki section. This line of some 26 miles or thereabouts is expected to be in operation in about a year's time. As well as this, however, a further proposal which appears likely to eventuate in the near future, is an electric railway scheme for the Rimutaka hills. An outline of this scheme has already been given by the Prime Minister, Mr. Savage, but no actual details are yet available. The cost, however, is roughly estimated at £1,000,000 for tunnelling the Rimutakas and £215,000 for the actual electrification.

Communications

Great Britain.—INTERCONNECTION OF TELEPHONE EXCHANGES.—Side by side with the systematic conversion of the whole British telephone system to automatic working, the Post Office is developing plans for directly connecting the automatic exchanges over wide areas. *The Times* states that by the end of this year more than half the telephone exchanges in Great Britain will be working on the automatic system. The complementary process of extending direct interconnection between exchanges will not yield visible results till probably about two years hence. It will be made possible by the introduction of new technical apparatus that will considerably reduce the time now needed to put through trunk calls. Subscribers in different towns several miles apart will then be able to call each other direct, as they do at present when making local calls. The new system will be first introduced experimentally on the North-East Coast. Subscribers will simply dial a two-figure code number followed by the subscriber's number.

MORE TELEPHONES FOR PADDINGTON STATION.—Owing to the growth in the use of the telephone the Great Western Railway is to install equipment which will provide one hundred additional extension lines from its private exchange at Paddington Station. The exchange was opened in 1934 with capacity for 1,000 extension lines of which 800 will now be brought into use.

India.—"CARRIER" TELEPHONE SCHEMES.—The Posts and Telegraphs Department proposes to establish a carrier current system of telephone communication between Madras and Trichinopoly (239 miles) and between Madras and Jalarpet (137 miles). New power plants are to be erected at Trichinopoly and Jalarpet, while the existing power plant will be used at Madras. The first carrier system in India was installed in 1932 between Bombay and Calcutta. Since then similar systems have been established between Bombay and Madras, Bombay and Delhi, Delhi and Lahore. It is also intended to install this system between Delhi and Calcutta and Bombay and Karachi by the end of next year and between Calcutta and Madras during the current year.

Peru.—TELEPHONE SERVICE INAUGURATED.—Telephone communication has recently been established between Lima and Trujillo, a distance of about 300 miles.

Tripoli.—COMMUNICATION WITH SICILY.—Work has started on the laying of a new telegraph and telephone cable, 386 nautical miles in length, between Tripoli and Sicily, learns *Reuter's Trade Service* from Italian papers. Starting from Tripoli it will reach Porto Empedocle and then be connected with Caltanissetta by means of an amplifying station.

Improving London's Railways

ALMOST everywhere passengers travel on London Transport's railways, from Elephant and Castle to Rickmansworth, they see construction work in hand. Work is proceeding, or is just about to begin, on forty-five stations, and a contract amounting to £120,000 has just been signed for the lengthening of thirteen additional platforms on the Bakerloo Line, making thirty platforms in all to be lengthened on this line. This will enable longer trains to be run—seven cars instead of six—when the extension to Stanmore is placed in service next year. The modernisation of Baker Street station is now well advanced, and additional escalators, new subways and ticket halls will soon be completed, with improved arrangements for exchanging between the Metropolitan and Bakerloo Lines and for access to the street. A working shaft has been sunk at Elephant and Castle station, which will be reconstructed to enable a 90-second peak train service to be operated. Compressed air plant is being installed because the work will have to be done in water-bearing ground. The line will have to be resignalled to allow for the more intensive service.

On the Central Line twenty-eight station platforms are being lengthened to permit longer trains to run. Without interrupting traffic, the whole of the 22 miles of existing tunnels have been realigned. A survey of the line was made and about 10,000 segments of cast-iron lining were removed and replaced to a more accurate measurement. Present-day contracts permit only a divergence from the centre line of 1 in. on either side. On the Central Line, in places, there was a divergence of as much as 8 in. The Board's engineers are now modernising the Central Line track, which employs the third rail with earthed return system, to conform with London Transport's standard track arrangement of the fourth rail insulated return. There will be bull-head rails with cross sleepers in place of the existing bridge type rail with longitudinal sleepers. More than 10 miles of new rails will have to be laid. They will be welded, thus reducing the number of joints and making for smoother train running. When the fourth rail has been laid throughout the line the signalling will be altered to permit more trains to be run. The new St. Paul's station will be in service in December and will be completed in March next.

Good progress is being made at Sloane Square, where the station will be modernised and escalators installed. This will be the first District Railway station to have escalators from the platforms direct to the street. The complicated reconstruction at Aldgate East is approaching completion. The present station will be closed and part of the new station, which will have two ticket halls below the surface of the street, will be opened for service at the end of this year. Apart from the construction of a new station at Aldgate East, the south curve of the District Line between Aldgate and Mark Lane is being lengthened.

Other stations at which important works are in hand include Highgate, from which the tube is being extended to join the L.N.E.R. surface line tracks at East Finchley, Notting Hill Gate, where the construction of a joint station with escalators has been begun; King's Cross, where the Metropolitan station is being built on a new site, and the exchange between the Northern and Piccadilly stations and communication with the main line stations are being improved by the installation of escalators; and Liverpool Street, where the new tube extension is being linked with the existing Central Line. Drawings are being prepared for the reconstruction of Liverpool Street station. At High Street, Kensington, the ticket office is being enlarged and the platforms are being improved.

At Mile End the new tube lines will be brought to sub-surface level and placed at the same level on either side of the existing Mile End Station on the Metropolitan and District Railway. At the same time a new sub-surface ticket hall is being constructed. On the Northern Line noise-reducing screens are being erected in the tunnels. About 6½ miles of work have been done. The Metropolitan Line is being improved between Baker Street and Wembley Park, and the reconstruction of Harrow-on-the-Hill station has begun. Contractors have commenced the earthworks necessary to the doubling of the line between Harrow and Rickmansworth.

Electricity Supply in France

Increasing predominance of hydro-electric output

FULL statistics relating to the generation and distribution of electricity in France during 1936 have been issued by the French Ministry of Public Works, which publishes abridged data every other year.*

On January 1st, 1937, hydro-electric stations in France with at least 1,000 kVA installed had a total installed capacity of 3,667,024 kVA, an increase of about 16 per cent. in two years (compared with 8.8 per cent. during the preceding two years). The available power† is given as follows: In running order 1,377,264 kW (1,302,864 kW on January 1st, 1935); under construction 109,095 kW (141,940 kW); projected 2,875,562 kW (3,060,037 kW); apparently practicable but no concession yet sought 1,528,145 kW (1,307,645 kW); total 5,905,306 kW (5,834,726 kW) including provisional installations. There was also on January 1st, 1931 (the latest date for these statistics) 267,018 kVA installed in 5,228 hydro-electric plants of less than 1,000 kVA each, with an "available power" of 186,268 kW.

A table shows the location, head and effective capacity of all water storages of at least 1 million cu. metres (35.3 million cu. ft.) capacity, storing not less than 1 million kWh. Tables relating to thermal power stations connected to public supply networks show, for each plant, its location, operators, installed capacity, available kW, and type of fuel burnt.

TABLE 1.—CAPACITY OF STATIONS BURNING SOLID FUELS.

	Installed kVA (Thousands).		Available kW (Thousands).	
	1937.	1935.	1937.	1935.
Ordinary central stations ...	4,872	4,500	3,157	3,342
Colliery stations	1,154	1,114	709	746
Stations at metallurgical works ...	50	94	35	65
Others	89	104	57	64
Totals	6,165	5,812	3,958	4,217

Presumably the increase in installed kVA and the decrease in available kW shown in Table I indicate a greater margin of reserve generator capacity and a reduction in the effective boiler capacity. The installed capacity of stations using only gaseous fuel was 213,250 kVA on January 1st, 1937 (330,200 kVA in 1935) and the available power 155,565 kW (compared with 252,220 kW); the decrease is almost entirely in stations at metallurgical works, but there is also 658,525 kVA (compared with 444,475 kVA) installed capacity in stations burning solid and gaseous fuels, the available power of which is 449,500 kW (compared with 336,100 kW).

Table 2 shows the increasing predominance of hydro-electric output. Of the total output of 16,659-million kWh for 1936 about 76 per cent. passed through distribution networks, 47 per cent. being derived from thermal and 53 per cent. from hydro-electric stations. On December 16th, 1936, at 5 p.m.,

TABLE 2.—INSTALLED CAPACITY AND ANNUAL OUTPUT.

Main Object.	Thermal Stations.				Hydro-electric Stations.			
	Installed kVA Millions.		Output Million-kWh.		Installed kVA Millions.		Output Million-kWh.	
	1936.	1934.	1936.	1934.	1936.	1934.	1936.	1934.
Distribution	2.76	2.79	1,859	2,012	1.13	1.08	2,716	2,296
Generation	2.23	2.04	1,849	2,327	1.67	1.34	3,685	2,721
Electro-chemistry or -metallurgy... ...	0.01	0.01	3	1	0.66	0.58	1,772	1,453
Mining...	1.53	1.47	2,370	2,179	0.02	0.05	35	155
Metallurgy	0.66	0.72	1,344	1,397	0.01	0.02	14	36
Others	0.23	0.07	399	61	0.26	0.26	614	534
Totals ...	7.42	7.10	7,823	7,977	3.74	3.32	8,836	7,195

the load on thermal power stations, of at least 5,000 kVA installed capacity, was about 1,621,000 kW, and on hydro-electric stations of at least 2,000 kVA installed capacity it was about 1,399,000 kW (total 3,020,000 kW). These stations together supplied about 95 per cent. of the total output to distribution networks in 1936.

TABLE 3.—COAL CONSUMPTION OF STATIONS WITH AT LEAST 1,000 kVA INSTALLED.

Year.	Output Million-kWh.	Lb. Coal per kWh.
1932	4,138	1.856
1933	4,399	1.706
1934	4,149	1.559
1935	3,778	1.528
1936	3,640	1.609

The coal consumption per kWh, excluding lignite, varies widely in the different regions; the lowest regional average in 1936 was 1.274 lb. per kWh generated in the Paris district with a total output of 1,618-million kWh.

The lengths of distribution lines, Table 4, show substantial increases in all categories excepting d.c. lines. Out of a total of 10,348-million kWh distributed in 1936 (9,466-million kWh in 1934), about 7,364- (compared with 6,706-) million kWh was taken at high voltage and 2,984- (2,760-) million kWh by low voltage power, lighting and domestic consumers.

TABLE 4.—DISTRIBUTION AND TRANSMISSION SYSTEMS.

Current and Voltage.	Mileage of Lines	
	1936.	1934.
D.c., not over 600 V	3,161	3,160
A.c., not over 150 V	104,185	94,776
A.c., 150–250 V	67,992	54,564
High voltage, below 60 kV, d.c., or 33 kV, a.c.*...	144,735	134,581
High voltage at least 60 kV, d.c., or 33 kV, a.c.*	12,006	10,169

* Between phase and earth.

In towns of over 40,000 inhabitants, the total distribution in 1936 (compared with 1934) was 3,409- (3,233-) million kWh, about 1,849- (1,814-) million kWh or 162 kWh (as before) per head of population at high voltage, and 1,560- (1,419-) million kWh or 136 (compared with 127) kWh per head for low-voltage power, lighting and domestic uses.

TABLE 5.—ANALYSIS OF FRENCH DISTRIBUTION SYSTEMS.

Networks distributing per annum:	No. of networks.		Million-kWh distributed.		Per cent. of total distribution.	
	1936.	1934.	1936.	1934.	1936.	1934.
Over 100-million kWh	31	31	5,750	5,613	55.6	59.3
50 to 100-million kWh	26	18	1,894	1,250	18.3	13.2
20 to 50-million kWh	40	46	1,255	1,487	12.1	15.7
10 to 20-million kWh	37	38	499	493	4.8	5.2
Under 10-million kWh	1,537	1,653	950	623	9.2	6.6
Totals ...	1,671	1,786	10,348	9,466	100.0	100.0

The number of communes with no electrical distribution has again been reduced, and on January 1st, 1937, it was 1,888 with a population of 615,046, compared with 2,236 (pop. 754,947) on January 1st, 1936, and 3,362 (pop. 1,230,996) on January 1st, 1934.

TABLE 6.—GROWTH OF ELECTRICITY CONSUMPTION.

Year.	1924.	1930.	1932.	1934.	1936.
Population, millions	40.3	41.6	41.8	41.9	41.5
Generation, 1,000-million kWh—					
Thermal stations	5.5	8.5	7.7	8.0	7.8
Hydro-electric stations ...	3.6	6.9	5.9	7.2	8.8
Consumption, 1,000-million kWh—					
Electrochemical	1.6	2.9	1.9	2.2	2.5
Other, with distribution ...	4.5	7.8	7.5	8.3	9.0
Other, without distribution ...	1.8	2.9	2.5	2.5	2.9
Loss, in conductors and transformers, per cent.	14.9	13.5	16.3	17.1	16.4
Per inhabitant per annum, kWh—					
Generated + net imports ...	231	379	337	373	414
Consumed	197	327	282	309	346

Out of a total consumption of 14,367-million kWh in 1936 (12,989-million kWh in 1934) about 11,383- (10,229-) million kWh was at h.v. as follows: for traction 1,050- (936-); electro-chemistry and electrometallurgy 2,501- (2,188-); and other uses 7,832- (7,105-) million kWh. The l.v. sales were 2,984- (2,760-) million kWh. The total number of low-voltage consumers was 10,721,488 (compared with 9,871,919), and the low-voltage consumption is made up of 2,067- (1,791-) million kWh for lighting and domestic uses, and 916- (969-) million kWh for power. The average total consumption of 346 kWh per inhabitant in 1936 (309 kWh in 1934) includes 50 kWh (43 kWh) for lighting. The total amount of energy distributed in towns of more than 40,000 population was 3,409- (3,233-) million kWh, *viz.*, 1,849- (1,814-) million kWh at high and 1,560- (1,419-) million kWh at low voltage. The averages per inhabitant were: High voltage 162 kWh (as before); low voltage power 38 (41) kWh; lighting and domestic uses 98 (86) kWh, low-voltage total 136 (127) kWh; grand total 298 (289) kWh, compared with 346 (309) kWh for the whole country.

* *Statistique de la Production et de la Distribution de l'Energie Electrique en France pour l'année* 1936.

† Defined as $N/8{,}760$, where N = total kWh that it is technically possible to generate in 8,760 hours. The "installed capacity" refers to the total kVA ratings of the generators in running order, including spare sets, and may be considerably greater than the boiler capacity of thermal stations or the capacity of hydro-electric turbines capable of simultaneous operation.

Contract Information

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses

Contracts Open

Australia.—MELBOURNE.—September 6th. Posts and Telegraphs Department. Cable. (T. 25622/38.)*
September 13th. Telephone plugs and sleeves. (T. 25673/38.)*
September 13th. Accumulator plates and separators. (T. 25892/38.)* Insulated jumper wire. (T. 25893/38.)*

Bideford.—September 9th. Town Council. Installation of electric lighting points at buildings in connection with an open-air swimming pool. Town Clerk.

Blackburn.—August 29th. Corporation. Electrical wiring and installation of electrical fittings at a new open-air school at Blackamoor.

Bute.—August 27th. County Council. Heating and electrical installations at new primary and advanced school at Lamlash, Arran. Clerk to Education Committee, Rothesay.

Cardiff.—September 12th. Electricity Department. 33,000-V and other p.i. cables, one six-panel and one two-panel switchboard, two 10,000-kVA and one 7,500-kVA transformers. (See this issue.)

Cheadle and Gatley.—September 12th. Electricity Undertaking. Meter-testing equipment. (See this issue.)

Chile.—SANTIAGO.—September 7th. Maritime Works Department. Two electric cranes for the Port of Iquique. (T.Y. 25414/38.)*

Darlington.—September 15th. Electricity Department. Fifty-five mercury vapour electric discharge street lamps. (See this issue.)

Dewsbury.—September 5th. Borough Council. Electrical stores. (See this issue.)

Dundee.—August 27th. Works Department. Three sets of electrically operated centrifugal pumps suitable for unscreened sewage. Specifications, &c., from D. B. McLay, city engineer, 21, City Square; tenders to Town Clerk.

Eastbourne.—September 10th. Borough Council. Complete electrical installation, telephone conduits, &c., at the new girls' secondary school, Eldon Road. (See this issue.)

Eccles.—August 29th. Public Health Committee. Installation of electric light wiring and fittings in 158 houses in course of erection at Worsley Road, Higher Croft and Peel Green Road. Town Clerk, Town Hall (deposit £1 1s.).

Eston.—September 1st. U.D.C. Steel kiosk sub-station with one 25-kVA transformer and h.v. and l.v. switchgear at North Lackenby, Grangetown. Electrical Engineer, Council Offices, Grangetown-on-Tees.

Haltwhistle.—R.D.C. Electric lighting installation at the Council offices. T. Dryden, Council Offices.

Heston & Isleworth.—August 26th. Electricity Department. One sheet steel kiosk, e.h.v. switchgear and 600-kVA transformer, 11-kV cable and pilot cable. (August 12th.)

India.—SIMLA.—September 6th. Indian Stores Department. Bare copper wire for the year ending January 31st, 1940. (T. 25612/38.)*

Langho (NEAR BLACKBURN).—September 1st. Committee of Management. Cinematograph installation, electric lighting fittings and water turbine pump for Brockhall Institution. (August 12th.)

London.—COMMISSIONERS OF H.M. WORKS.—September 2nd. Steel conduits and fittings for electric wiring. (August 19th.)
METROPOLITAN WATER BOARD.—September 21st. One high-compression heavy fuel-oil engine with electric generator and centrifugal pumps, one borehole pump, &c., at Wansumt pumping station. G. F. Stringer, Clerk of the Board, 173, Rosebery Avenue, E.C.1.
HAMMERSMITH. — August 29th. Electricity Department. Three-phase l.v. switchboard. (August 19th.)

Manchester.—September 7th. Electricity Department. One electrically propelled van. (August 19th.)
September 16th. Three-phase, 6,600-V switchgear over a period of two years. (See this issue.)
October 7th. Supervisory control equipment at sub-stations. (See this issue.)

Margate.—September 5th. Borough Council. Electrical plant for the Corporation's sewage pumping station, Foreness Point. (See this issue.)

Newcastle-under-Lyme.—August 30th. Electricity Department. One transformer kiosk with e.h.v. and l.v. switchgear to house and control existing transformer. (August 19th.)

New Zealand.—WELLINGTON.—Public Works Department. November 8th. 3,320 strings of e.h.v. transmission line suspension and strain insulators. (T. 25527/38.)*
October 11th. Three rotary d.c. welding plants. (T. 25313/38.)*
September 20th. Two electrically driven air compressors. (T.Y. 25315/38.)*
January 17th. Power and control cables for extensions at the Waitaki power station. (T. 18568/38.)*
January 24th. 110-kV outdoor switchgear and steelwork. (T.Y. 250/38.)*
October 25th. Diesel-electric generating set and switchgear. (T.Y. 25941/38.)*
Posts and Telegraph Department. October 11th. 140 tons of cadmium copper wire. (T. 25553/38.)*
September 29th. Five motor-generator sets (T. 18565/38.)*
October 11th. Telephone cable. (T. 25936/38.)*
CHRISTCHURCH.—September 29th. Municipal Electricity Department. Sixteen 333-kVA, single-phase transformers. (T. 25943/38.)*

Northern Ireland.—BELFAST.—September 9th. Electricity Department. Electric water-heating equipment and a.c. motors and wiring to replace existing d.c. installation at consumer's premises. (See this issue.)

Penicuik.—September 3rd. Town Council. Electric lighting at thirty-two houses at John Street. Schedules from Morham & Brotchie, F.S.I., surveyors, 29, Hanover Street, Edinburgh; tenders to Town Clerk.

Plymouth.—September 3rd. Corporation. L.v. distribution boards and underground network disconnecting boxes. (August 12th.)

South Africa.—JOHANNESBURG.—September 14th. City Council. Fourteen metal clad l.v. a.c. switchboards. (T. 25412/38.)*
September 12th. Railways and Harbours Administration. Electric lamps for twelve months. (T. 25856/38.)*
September 29th. Union Tenders and Supplies Board. Detectors. (T. 25862/38.)*
MOSSEL BAY.—September 24th. Municipality. Generating plant, transformer and cable. (T. 25577/38.)*

Stoke-on-Trent.—September 7th. Electrical Engineer's Department. Cookers, wash-boilers, kettles, storage water heaters and circulators. (August 12th.)
August 29th. Town Council. Electric lighting and heating installation in the lecture hall, &c., at St. George's Chambers, City electrical engineer, 31, Kingsway (deposit £2).

Tobermory.—September 6th. Town Council. Electric lighting at housing estate. Town Clerk (deposit £1 1s.).

Wakefield.—September 5th. Lighting installation at Thorne school. Education officer, County Hall.

Wath-upon-Dearne.—August 27th. Installation of wiring and fittings in eighty houses and bungalows. W. E. Haigh, Town Hall.

West Ham.—September 5th. Electricity Department. V.i.r. and tough rubber-sheathed wires and cables for one year. (August 12th.)

Weymouth.—August 31st. Dorset County Council. Electrical installations in new technical school. (August 12th.)

Wolverhampton.—September 23rd. West Midlands J.E.A. Electrical installation at Ironbridge generating station, Buildwas, near Ironbridge, Salop. (See this issue.)

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* Further particulars from the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, London, S.W.1.

Contracts Closed

Birmingham.—Colonial Mutual Insurance Society, Ltd. Accepted. Electrical installation at new offices, Great Charles Street.—W. J. Furse & Co.

Coatbridge.—Town Council. Accepted. Electrical work at sixty-four houses.—A. Craig.

Darlington.—Town Council. Accepted. Electric meter testing equipment (£990).—Ferranti.
Accepted. Installation of an internal telephone system at the electricity offices (£291).—Dictograph Telephones.

Dundee.—Education Committee. Accepted. Electric clocks and bell installation at St. Mary's R.C. School, Lochee (£92).—Magneta Time Co.
Public Health Committee. Accepted. Electric lighting at additions to nurses' home at Maryfield Hospital (£720).—D. J. Macdonald. Installation of electric lighting in attendant's house, administrative block, &c., at King's Cross Hospital (£115).—R. Kilpatrick.
Housing Committee. Accepted. Electric lighting installation at Polepark (£652).—Stenson & Co.

Glasgow.—Health Committee. Accepted. Electrical installations at Holmfauldhead Drive housing estate (162 houses) (£1,483).—A. A. Moore.

Hastings.—Housing Committee. Accepted. Electrical installation at Old Town flats (£249).—R. P. Biker.
Electricity Committee. Accepted. Fire protective equipment (£761).—Mather & Platt. Automatic section couplers (£208).—J. G. Statter & Co.

Newcastle-on-Tyne.—City Council. Accepted. Electric lamps (total cost £2,698).—Siemens Electric Lamps & Supplies; Edison Swan Electric Co.; G.E.C.; Met.-Vick. Elecl. Co.; Foster Engineering Co.; J. Gledson & Co.; British Electrical & Manufacturing Co.; Philips Lamps; Reid, Ferens & Co.; B.T.H. Co.; T. J. Grainger & Co.; Crompton Parkinson & Co.; Albion Electric Lamp Works; Thorn Electrical Industries; Vale Royal Electric Co.; Omega Lamp Works; A. S. McHugh & Co.
Accepted. Self-balancing electrically driven hydro-extractor for Elswick Grange (£180).—Sanderson Bros.
Accepted. Electrical installation at the new Whickham View schools (£1,824).—A. S. Lowrey.

Worcestershire.—Education Committee. Accepted. Electrical installations: Halesowen technical school (£449) and Stourbridge senior school (£349).—T. R. Priest. Halesowen girls' school (£385).—Gwilliam Bros.
Health Committee. Accepted. Electric laundry callender for Bromsgrove institution (£611).—Manlove, Alliott & Co.

Personal and Social

Information regarding new appointments and other matters of interest for this page are welcomed

A GROUP of engineers and scientific workers from the British Association (which met this week at Cambridge) spent an instructive afternoon visiting the Letchworth Works of Kryn & Lahy (1928), Ltd., and their associated company, J. Browett Lindley (1931), Ltd., on August 18th. They included Sir Alexander Gibb, Prof. Southwell (president of the Engineering Section and Professor of Engineering at Oxford University), Prof. F. G. Baily (Emeritus Professor of Engineering at Edinburgh University), Prof. G. W. O. Howe (Professor of Electrical Engineering at Glasgow University) and Prof. John (Professor of Electrical Engineering at Queen Mary College, E. London).

British Association delegates at the works of Kryn and Lahy (1928), Ltd., at Letchworth. Our picture shows a group in front of the melting plant

Mr. E. V. Boddis, resident engineer of the Electricity Co. of Macclesfield, Ltd., is going to Madeira temporarily to manage the Madeira Electric Lighting Co., while the regular manager, who is convalescing after illness, returns to England. The company is controlled by the same concern as the Macclesfield Co. Mr. Boddis, who will be stationed at Funchal, is to sail from Southampton on August 27th and will be away two or three months. **Mr. L. Howard** will deputise as resident engineer in Macclesfield during his absence.

Mr. W. Johnson, who is secretary and a director of Thos. W. Ward, Ltd., Sheffield, has completed fifty years' service with the company. He has been presented with a cheque by the directors, and the older members of the staff have presented him with an electric clock and reading lamp.

Mr. John Ismay has resigned from the managing directorship of Ismay Industries, Ltd., but remains chairman of the company. **Mr. H. H. Scott** has resigned from the board, and **Mr. A. E. Somers** has joined the board and has been appointed managing director. As announced in our last issue Mr. Somers has been elected a director and appointed chairman of Britannia Electric Lamp Works (1934), Ltd., in place of Mr. J. Ismay.

Mr. A. J. Evans, of Bylock Electric, Ltd., has been appointed London sales manager of the company. He has been connected with the electrical trade for twenty years.

Mr. H. D. Fletcher, who is now employed in the mains department of the Corporation Electricity Department, Loughborough, Leics., is leaving the town in September to take up the post of assistant engineer (distribution) with the Sheffield Corporation Electricity Department.

Mr. J. Hefferan, meter test-room superintendent, is terminating his services with the Barking Corporation Electricity Department to take up the appointment of meter superintendent with the Hastings Corporation.

Mr. E. K. Cole, hitherto deputy managing director of E. K. Cole, Ltd., has been appointed managing director in the place of **Mr. W. S. Verrells,** who, however, will continue as chairman of the company.

I.E.E. Scholarship Awards.—The following scholarships have been awarded by the Institution of Electrical Engineers for 1938:—Ferranti Scholarship (annual value £250, tenable for two years) to Mr. L. S. Piggott, M.Sc.(Eng.) (Oxford University). Duddell Scholarship (annual value £150, tenable for three years) to Mr. J. B. Higham (Penarth County School). Silvanus Thompson Scholarship (annual value £100, plus tuition fees, tenable for two years) to Mr. H. Darnell (Mersey Railway Co.). Swan Memorial Scholarship (annual value £120, tenable for one year) to Mr. J. G. Hutton, B.Sc. (Sunderland Technical College). David Hughes Scholarship (value £100, tenable for one year) to Mr. H. E. Newton (Sheffield University). Salomons Scholarship (value £100, tenable for one year) to Mr. C. Halliday (King's College, Newcastle-on-Tyne). War Thanksgiving Education and Research Fund (No. 1): Grants made as follows: £50 to Mr. J. W. Carroll (King's College, London); £25 to Mr. E. Franklin (Birmingham University); £25 to Mr. G. Y. Shute (University College, Nottingham). Thorrowgood Scholarships (annual value £12 10s., each, tenable for two years) to Messrs. C. R. Smith (London & North Eastern Railway) and E. C. Norris (Southern Railway Co.).

Mr. E. A. Lever, B.Sc., B.Com., for the past seven years general sales manager of Pye, Ltd., has been appointed sales manager of the "Prestcold" department of the Pressed Steel Co., Ltd.

Mr. R. A. C. Johnson and **Mr. W. H. Rogerson** have been appointed to the board of Richard Johnson & Nephew, Ltd.

Obituary

Mr. D. Dunbabin.—One of the first employés at the British Insulated Cable Works, Helsby, Mr. Daniel Dunbabin, died last week at the age of seventy-nine. He had been employed at the works for forty-five years, retiring seven years ago. He started with the T.M.C. Co. when the works were first opened in 1886, and he became superintendent of the battery and insulator department.

Mr. E. W. Smith.—We regret to record the death of Mr. Ernest William Smith, chairman of Smith Meters, Ltd., which occurred on August 18th at the age of fifty-nine.

Wills.—Dr. W. Stroud, chairman of Barr & Stroud, Ltd., left personal estate in Great Britain valued at £152,299.

Sir John F. C. Snell, late chairman of the Electricity Commissioners, left £11,925, with net personalty £10,324.

Financial Section

New Companies. Official Returns of Capital. Debenture Charges. Reports of Electrical Companies. Dividend Announcements. Transactions in Stocks and Shares

New Companies Registered

International Electrical and Engineering Trust, Ltd.—Private company. Registered August 18th. Nominal capital, £100. Objects: To acquire and hold shares, stocks, debentures and securities, &c. The subscribers are: I. F. Stewart, Minster House, St. James Court, S.W.1; and A. T. Neale, Cowley Bank, 15, Rodney Road, New Malden. The first directors are to be appointed by the subscribers. Secretary: J. F. Stewart.

Interpublicity, Ltd.—Private company. Registered August 17th. Capital, £100. Objects: To carry on in London and elsewhere the business of wireless, telegraphic, wireless relay, sound film, mechanical, electrical and general engineers, producers of broadcasting and television programmes, sound films, &c. The subscribers are: H. J. Modrey, LL.D., Stockleigh Hall, Regent's Park, N.W.8; and A. Burton, 5, Pitshanger Court, Pitshanger Lane, W.5. Secretary: Alfred Burton.

Polarising Materials, Ltd.—Private company. Registered August 20th. Capital, £100. Objects: To carry on the business of manufacturers of, agents for and dealers in sheet or film cellulose, chemicals, metals, instruments, plant, machinery, materials and experimental and demonstration outfits used in connection with the polarisation of light, &c. The subscribers are: H. S. B. Meakin, 30, Ebury Street, S.W.1, and C. A. Fisher, Hillcroft, 39, Moffats Lane, Brookmans Park, Herts. H. S. B. Meakin is permanent director and chairman.

Duopoint, Ltd.—Private company. Registered August 18th. Capital, £100. Objects: To carry on the business of electrical, marine and general engineers, &c. The subscribers are: G. K.

Raffan, 4, Arundel Gardens, W.11; F. H. le Sueur, 60, Leinster Square, W.2; and J. S. Waters, 15a, Amelia Street, Walworth Road, S.E.17. Registered office: 15a, Amelia Street, Walworth Road, S.E.17.

Tom Jones (Electrical Engineers), Ltd.—Private company. Registered August 18th. Capital, £500. Objects: To carry on the business of electrical contractors and engineers, &c. The permanent directors are: T. R. Jones and Mrs. E. Jones, both of 39, Heathfield Road, Liverpool. Registered office: 5, Church Road, Wavertree, Liverpool, 15.

Neon Signs (Ulster), Ltd.—Private company. Registered in Belfast August 15th. Capital, £2,000. Objects: To manufacture, purchase, hire, procure on the hire-purchase system or otherwise acquire all classes of neon and other signs, &c. The first directors are: G. H. Kenny, Millisle Road, Donaghadee, Co. Down; L. Scop, 17, Downview Avenue, Belfast; J. Y. Moore, 35, Deramore Park, Belfast; L. Carroll, 25, Sheridan Drive, Bangor, Co. Down; and W. R. Rawlinson, 30, Knockdene Park, Belfast. Registered office: Ocean Buildings, 2, Donegall Square East, Belfast.

Emanotherapy Association, Ltd.—Private company. Registered August 15th. Capital, £2,400. Objects: To acquire the joint undertaking for research and development in emanotherapy belonging to Major C. J .P. Ball and J. W. Bell, and to carry on the business of manufacturers of and dealers in apparatus and preparations for emanotherapy and radiology, violet ray, and X-ray tubes and apparatus, &c. The first directors are: B. J. Hamlin, 68, Mitcham Lane, Streatham, S.W.16; and J. W. Bell, "Pailton," 3, Queen's Road, Cheltenham. Solicitors: Culross and Co., 65, Duke Street, Grosvenor Square, W.1.

Harweb, Ltd.—Private company. Registered August 17th. Capital, £250. Objects: To carry on the business of manufacturers, distributors and repairers of and dealers in electrical and mechanical apparatus and accessories and components of all kinds, and in particular of wireless sets, valves, &c. The first directors are: R. D. M. Hardy, 153, Copnor Road, Portsmouth; and Mrs. M. E. Webster, 4, Hawthorn Crescent, Cosham, Portsmouth.

Returns of Electrical Companies

British Thomson-Houston Co., Ltd.—Capital, £4,000,000 in 2,000,000 7 per cent. cumulative preference and 2,000,000 ordinary shares of £1. Return dated April 5th, 1938. 1,500,000 preference and 2,000,000 ordinary shares taken up. £3,425,310 paid, £74,690 considered as paid. Mortgages and charges: £1,296,420.

Neon Hire & Supply Co., Ltd.—Capital, £1,500 in 250 preference of £1 and 25,000 ordinary shares of 1s. Return dated May 31st, 1938. All shares taken up. £1,250 paid on 250 preference and 20,000 ordinary shares, £250 considered as paid on 5,000 ordinary shares. Mortgages and charges: £500.

Brentford Electric Supply Co., Ltd.—Capital, £100,000 in £1 shares. Return dated March 15th, 1938. 90,000 shares taken up. £90,000 paid. Mortgages and charges nil.

Oriental Telephone & Electric Co., Ltd.—Capital, £900,000 in 600,000 ordinary and 300,000 preference shares of £1. Return dated May 10th, 1938. 570,199 ordinary and 188,791 preference shares taken up. £479,918 10s. paid on 291,115 ordinary and 188,791 preference shares, including £12 10s. paid on 50 forfeited shares, £279,084 considered as paid on the remainder. Mortgages and charges nil.

Hart Accumulator Co., Ltd.—Capital, £200,000 in 180,000 ordinary and 20,000 preference shares of £1. Return dated April 11th, 1938. 156,708 ordinary and 19,523 preference shares taken up. £38,411 paid, £137,820 considered as paid. Mortgages and charges nil.

Key Engineering Co., Ltd.—Capital, £5,000 in 4,993 ordinary and 7 deferred shares of £1. Return dated March 28th, 1938. 4,220 ordinary and 7 deferred shares taken up. £4,227 paid. Mortgages and charges: £2,560.

Ilfracombe Electric Light & Power Co., Ltd.—Capital, £50,000 in £5 shares. Return dated April 27th, 1938. All shares taken up. £50,000 paid. Mortgages and charges nil.

Direct Electric Lamp Co., Ltd.—Capital, £1,000 in £1 shares. Return dated December 31st, 1937 (filed March 24th, 1938). Four shares taken up. £4 paid. Mortgages and charges: £1,000.

Burgess Hill Electricity, Ltd.—Capital, £65,000 in £1 shares. Return dated May 9th, 1938. 52,250 shares taken up. £50,400 paid, £1,850 considered as paid. Mortgages and charges nil.

Altrincham Electric Supply, Ltd.—Capital, £310,000 in 100,000 ordinary, 49,650 1st preference and 103,350 ordinary preference shares of £1 and 228,000 deferred shares of 5s. Return dated June 1st, 1938. 100,000 ordinary, 45,000 1st preference, 63,380 2nd preference, and 228,000 deferred shares taken up. £155,350 paid on 75,000 ordinary, 45,000 1st preference, 10,000 2nd preference and 101,400 deferred shares, £110,000 considered as paid on 25,000 ordinary, 53,350 2nd preference and 126,600 deferred shares. Mortgages and charges nil.

British Electric Transformer Co., Ltd.—Capital, £1,000,000 in 190,625 preference and 375,000 ordinary shares of £1 and 1,737,500 ordinary shares of 5s. Return dated December 24th, 1937 (filed January 27th, 1938). 190,625 preference and 400,000 ordinary shares of 5s. taken up. £266,518 12s. 6d. paid on 176,518 ½ preference and 360,000 ordinary shares, £24,106 7s. 6d. considered as paid on 14,106 ½ preference and 40,000 ordinary shares. Mortgages and charges nil.

Anglo-Portuguese Telephone Co., Ltd.—Capital, £1,700,000 in £1,199,375 ordinary stock and 400,625 ordinary and 100,000 "A" ordinary shares of £1. Return dated April 27th, 1938. £1,199,375 ordinary stock and 100,000 "A" ordinary shares taken up. £1,078,223 9s. paid (£1 per share on 1,000,856 shares, plus 3s. per share premium on 309,533 shares and £298,519 considered as paid on 298,519 shares, and 5s. per share premium on 123,750 shares). Mortgages and charges: £275,000.

Jarrow & District Electric Traction Co., Ltd.—Capital, £60,000 in £1 shares. Return dated April 6th, 1938. 59,934 shares taken up. £49,945 paid, £9,989 considered as paid. Mortgages and charges nil.

Giffens, Ltd.—Capital, £5,000 in £1 shares. Return dated December 4th, 1937 (filed May 11th, 1938). All shares taken up. £2 paid, £4,998 considered as paid. Morgages and charges nil.

City Notes

Strand Electric Holdings, Ltd., reports a gross trading profit of the Strand Electric & Engineering Co. and its subsidiaries of £50,168 for the year ended April 30th as compared with £44,191 for the preceding year. After deducting expenses, depreciation and other charges, the consolidated profit was £17,127, as against £15,392. During the year the works were removed to a larger factory in order to cope with an increasing turnover. The cost of this and other non-recurring items, amounting to £2,490, has been written off. This left the net profit, before tax, at £14,631, a decrease of £761. The dividend to the Holding Co. amounted to £12,149 (against £14,345), and after deducting expenses the net profit, before tax, was £11,316 (against £13,841). Tax required £3,043. The dividend is maintained at 10 per cent., less tax for the year, by the final payment of 6 per cent., and the amount carried forward is £179 lower at £2,685.

The Compania de Electricidad Buenos Aires reports a total income for 1937 of £423,528, as compared with £411,623 in the preceding year. Working expenses totalled £231,136 (against £223,991), and after providing for reserve for amortisation of invested capital (£77,759), sundry reserves (£14,000), directors' fees (£1,240), managers' remuneration, general expenses, &c. (£8,120), and loss on exchange (£6,888), there is a net balance of £84,386. Reserve receives £4,219 and further allocation £4,820. The dividend on the pre-preference shares is maintained at 8 per cent., and on the preference shares at 6 per cent. The sales of electricity increased by 8.55 per cent., and the number of consumers by 6.53 per cent.

The American Telephone & Telegraph Co. is paying a quarterly dividend of $2.25 (same).

Barton & Sons (1935), Ltd., is offering to shareholders at par 150,000 £1 6 per cent. redeemable cumulative preference shares. The issue has been underwritten jointly by Mr. H. Rothbarth and the Federated Trust and Finance Corporation for £10,000. According to the *Financial Times* new capital is required for the development and general purposes of the associated businesses and to complete the contract for the purchase of 80 per cent. of the issued share capital of Metal Frames.

Companies to be Struck off the Register.—The names of the following companies will be struck off the Register at the expiration of three months unless cause is shown to the contrary:—Cotton Electrical Appliances, Ltd.; Palmers Green Radio Service, Ltd.; R. B. Stones Radio, Ltd.; St. Margarets Radio Co., Ltd.

Companies Struck off the Register.—The names of the following companies have been struck off the Register and they are thereby dissolved:—Electrical & Radio Products (1931), Ltd.; Ideal Radio Supplies (London), Ltd.; Thames Valley Radio Service, Ltd.; Ward Electrical Co., Ltd.

W. Canning & Co. are paying an interim dividend of 5 per cent., less tax (same).

Walsall Conduits, Ltd., is maintaining its interim ordinary dividend at 20 per cent., less tax.

Stocks and Shares

TUESDAY EVENING.

THE volume of business in the general markets of the Stock Exchange gives no indication of expansion. The number of recorded bargains on each business day, as set out in the Stock Exchange Official List, is running now at about 5,000 bargains per week less than that of a year ago. This tells its own story. The falling-off is due mainly to a couple of causes: first, the uncertainty of Continental politics, and secondly the continued impression that industry in our own country is on a considerably smaller scale than it was a year ago.

The home railway traffics are still disappointing. The Cable and Wireless index for July is the smallest for that month published since July, 1931. Such pointers do not make for confidence, though they should, from the abstract point of view, be of service to the safety-first stocks into which capital usually flows at any period of nervousness in regard to the financial outlook. Speculation is quiet and investment equally languid. Negative consolation may be derived from the fact that prices of most stocks and shares, apart from those in specialised markets, maintain their ground with noteworthy firmness. The extreme slackness of business has been relieved to a slight extent by the lively interest aroused over the Test match.

Cable and Wireless Traffics

Normally there is a falling-off between June and July in the volume of Cable and Wireless traffics. On this occasion, the drop is rather bigger than usual; the July index of 63.1 compares with the June figure of 66.4, and with 73.4 for last year's corresponding month. July was the third full month in which the inter-Empire flat rates were operative. An increase in traffics, against the seasonal trend, between May and June had previously raised hopes of an early success for the cheaper charges. Sobered by the July figures, optimism has to fall back, for the present, on the expectation that the development of greater activity will be a slow but sure process. Hopes of an early improvement find little encouragement in the latest British overseas trade statistics, or in the slowing down of Wall Street business, both of which factors have, of course,

a considerable say in determining the volume of communications. The Stock Exchange market has been upset by the July index, the preference stock falling 2¼ to 94¼ and the ordinary being 4½ down at 47½. Globe ordinary eased off, in sympathy, to 31s. 3d., though the preference shares at 27s. 6d. are 6d. better.

Gilt-edged Yields

Prices of British Government stocks are now almost exactly where they stood at the beginning of the year. The political and trade news is diverting money from the industrial and speculative markets towards gilt-edged securities in general. In particular, the predilection remains for stocks within sight of the dates and prices at which they are due for repayment. The argument is, of course, that at the present premiums, prices have more room for a fall than a rise. Scope for an upward movement seems, indeed, fairly limited when the long-dated or irredeemable issues, such as War Loan, return less than 3½ per cent. on the money, while others that are due for redemption in a few years time yield no more than 2 or 2½ per cent., allowing for repayment. Consequently, the favoured issues are those which, by reason of their repayment terms, are more or less tied to the neighbourhood of par.

Central Electricity Board Stocks

Stocks of the Central Electricity Board stand outside the Trustee list, and, on account also of the distant redemption dates, the yields are a shade higher than those on British Government issues. The shortest-dated stock is the 5 per cent. loan 1950/70, which, at 113¾, yields £4 7s. per cent. outright, or £3 9s. per cent. to redemption. On the 3¼ per cent. 1974/94 issue, at 94, the return is a little less than 3½ per cent., allowing for the six points profit on repayment. There is a flat yield of 4 per cent. on the 4½ per cents. of 1957/82, which will pay £3 12s. over the full period. Nearest to par is the 3½ per cent. stock of 1963/93. At the current price of 101, the return is, of course, just under 3½ per cent., with a negligible loss on repayment.

Electrical Equipment Shares

No attempt is being made in the market to guess a likely date for the publication of the terms on which Callenders Cables and Crompton Parkinson will agree to join forces. It is thought that many complexities will be involved in finding a common basis for companies which differ widely in many respects. Meanwhile, Callenders have eased off from 5 to 4⅞ and Cromptons are 1/16 down at 26s. 3d. Both prices represent a useful advance since the idea of a partnership first spread abroad. Rumour is still busy turning the partnership into a trio. Some people connect this talk with the recent activity in Enfield Cables, which have lately risen from 2¼ to 2 11/16, and are now 2⅝. There is nothing authoritative to give substance to the rumour. Siemens are dull at 23s. 9d., and there are small declines in Associated Electrics at 38s., Ericssons at 38s. 9d., and Crabtrees at 25s. Strand Electrics fell from 5s. to 4s. 6d. after the dividend announcement, but picked up to 4s. 9d., ex-dividend, on publication of the report. As a whole, the conditions of this market are coloured by the general quietude among industrials.

American Reflections

City men home from a recent visit to what is called the financial district of New York are inclined to be cautiously hopeful of the prospects in the States. That business conditions are a good deal better than they were in the early spring is manifest by a number of agreed pointers. Whether the substantial rise in Stock Exchange prices, over the same period, can be justified here and now is a matter upon which opinions differ. The bears maintain that the rise has gone too far. The bulls contend that the outlook warrants to-day's prices, and higher. Our own country has a profound interest in the controversy because of the influence exerted by American factors over the prices of commodities and base metals. In both hemispheres the eyes of finance watch with close attention the policy of Mr. Roosevelt. Next November's elections in the States may play an important part in shaping the course of the presidential election later on. For American prices to keep, on balance, so steady as they are now is regarded as testimony to a belief in Wall Street that Governmental interference from Washington is not going to be too aggressively employed against big business interests.

Miscellaneous Matters

The trickle of business passing in home electricity supply shares has been insufficient to make any impression on share prices. In the overseas group, Victoria Falls are 1/16 lower, at 73s. 9d. There is little change among the newly issued stocks, South Metropolitan new 4 per cent. preference being quoted at 20s. 6d.—the issue price—and the 3½ per cent. debentures at ½ discount below par. B.C. & H. Power debentures are at ½ premium over the offered price of 99. Tillings, at 45s., are a few pence higher, and other traction stocks are mostly steady. Prices in the home railway market are lower than they have been for several years. Steel and engineering shares are on the heavy side, due to the successive reductions in the monthly steel output figures. British Aluminiums, at 48s. 9d., are dull, mainly on account of uncertainty over the significance of the recent cut in the aluminium price. The rubber market follows Wall Street at a respectful distance.

Share List of Electrical Companies

	Dividend. Nom.	Previous.	Last.	Price Aug. 23.	Rise or Fall.	Yield p.c. £ s. d.
HOME ELECTRICITY COMPANIES.						
Bournemouth and Poole	1	15	15	66/3xd.	+1/–	4 10 7
City of London	1	7½	7½	33/6xd.	+6d.	4 9 7
Clyde Valley	1	7	8	38/–	—	4 4 3
County of London	1	10½	10½	49/6	—	4 4 7
Edmundson's 7% Pref.	1	7	7	32/6	—	4 7 6
Do. Ord.	1	8	9	27/–	—6d.	—
Elec. Dis. Yorkshire	1	9	9	43/9	+1/16	4 2 2
Elec. Fin. and Securities	1	12½	12½	50/–	—	5 0 0
Elec. Supply Corporation	1	11	12	53/9	—	4 9 5
Lancs Light and Power	1	7½	7½	32/–	—	4 13 9
Lond. Assoc. Electric	1	—	7	30/–	—	4 13 4
London Electric	1	8	7	35/6	—	3 19 0
London Power Deb. Red.	Stock	5	5	105xd.	+2	4 15 3
Metropolitan	1	10	12	50/–	—	4 16 0
Midland Counties	1	7½	8	38/–	—	4 4 3
Mid. Elec. Power	1	8	9	40/9	—	4 8 3
North Eastern Electric Ordinary	1	7	7	33/–	—	4 4 10
Do. 7% Pref.	1	7	7	33/–	—	4 4 10
Northampton	1	10	10	46/3	—	4 6 7
Notting Hill 6% Pref.	10	6	6	14	—	4 5 9
North Met. Elec. Ordinary	1	10	10	48/9	—	4 2 0
Do. do. 6% Pref.	1	6	6	29/6	—	4 1 4
Scottish Power	1	8	8	38/–	—	4 4 3
South London	1	7	7	32/–	—	4 7 6
Victoria Falls Ord.	1	12	13½	73/9	—1/8	3 13 0
Whitehall Elec. Invst. 7½% Pref.	1	7½	7½	18/9	—	8 8 0
Yorkshire Elec.	1	8	8	41/–	—	3 18 1
PUBLIC BOARDS.						
Central Electricity, 1950–70	Stock	5	5	113	—	4 8 6
Do. 1955–75	,,	5	5	116½	—	4 5 10
Do. 1951–73	,,	4½	4½	109	—	4 2 7
Do. 1963–93	,,	3½	3½	101	—	3 9 4
London Elec. Trans. Gtd.	,,	2½	2½	92	—	2 14 4
London & Home Counties, 1955–75	,,	4½	4½	112½	—	4 0 0
London Passenger Transport, A...	,,	4½	4½	118½	—	3 16 9
Do. do. B...	,,	5	5	119½	—	4 3 8
Do. do. C...	,,	4	4½	73½	—	5 15 8
West Midlands Joint Elec. 1948–68	,,	5	5	113	—	4 8 6
TELEGRAPH AND TELEPHONE.						
American Tel. & Tel.	$160	9	9	144½	—	6 4 7
Anglo-Am. Tel. Pref.	Stock	6	6	119½	–½	5 0 7
Do. Def.	,,	1½	1½	26	—	5 15 5
Cable & Wireless 5½% Pref.	,,	4½	5½	94½	–2½	5 16 5
Do. Ord.	,,	—	4	47½	–4½	8 8 6
Do. Income	,,	—	—	102	—	3 18 2
Globe Tel. & Tel. Ord.	1	5½*	7½*	31/3	—9d.	4 16 2
Do. do. Pref.	1	6	6	27/6	+6d.	4 7 3
Great Northern Tel.	10	20	20	40	+1½	5 0 0
Marconi-Marine	1	10	7½	27/6	—	5 9 1
Oriental Telephone Ord.	1	12*	12*	57/6	—1/8	4 3 8
HOME AND FOREIGN TRAMS, ETC.						
Anglo-Arg. Trams First Pref.	5	Nil	Nil	5/–	—	—
Do. do. 2nd Pref.	5	Nil	Nil	5/–	—	—
Do. do. 5% Deb.	Stock	Nil	Nil	11	–1	—
British Electric Traction Def. Ord.	,,	5	5	950	—	—
Do. do. Pref. Ord.	,,	8	8	170	—	4 14 2
Brazil Traction	$100	70 cts.	$1	12	—	—
Brit. Columbia Elec. Rly. Pce.	Stock	5	5	100	—	5 0 0
Mexican Light Common	$100	Nil	Nil	1	—	—
Do. do. 1st Bonds	$500	5	5	25½	—1	—
West Riding	1	6½	10	35/–	—	—
MANUFACTURING COMPANIES.						
Aron Electricity Ord.	1	15	15	1⅝	—	9 4 8
Assoc. Elec. Ord.	1	10	10	38/–	—6d.	5 5 3
Do. Pref.	1	8	8	37/–	—	4 6 6
Babcock & Wilcox	1	10	10	37/–	—6d.	5 8 1
British Aluminium Ord.	1	10	12½	48/9	—9d.	5 2 6
British Insulated Ord.	1	20	20	4⅝	—	4 6 6
Brush Ord.	5/–	Nil	Nil	5/3	—	—
Callenders'	1	20	20	4⅞	—⅛	4 2 0
Do. 6½% Pref.	1	6½	6½	31/3	—	4 2 4
Crompton Parkinson Ord.	5/–	12½	12½	26/3	—1/8	—
Do. 8% Pref.	1	8	8	37/6	—	4 5 4
Electric Construction	1	10	12½	33/9	—	7 8 0
Enfield Cable Ord.	1	25	25	2⅝	—1/8	—
English Electric	1	Nil	10	30/6	—	6 11 0
Do. do. Pref.	1	6½	6½	26/–	—	5 0 0
Ericsson Tel.	5/–	25	25	38/9	+1/8	3 4 6
Ever Ready	5/–	45	35	18/6	—	9 9 2
Ferranti Pref.	1	7	7	27/6	—	5 2 0
G.E.C. Pref.	1	6½	6½	32/6	—	4 0 0
Do. Ord.	1	17½	20	77/–	—	5 4 0
Henley's	5/–	15	20	21/3	—	4 14 1
Do. 4½% Pref.	1	4½	4½	21/3	—	4 4 8
India-Rubber Pref.	1	5½	5½	21/3	—	5 3 6
Johnson & Phillips	1	10	12½	38/9	—	6 8 10
Lancashire Dynamo	1	20	25	3	—	8 6 8
Siemens Ord.	1	7½	7½	23/9	—1/8	6 6 4
Telegraph Construction	£1	7½	10	2½	—	4 14 0

* Dividends are paid free of Income Tax.

New Patents

Electrical specifications recently published

Compiled by a firm of chartered patent agents. The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (1s. each) can be obtained from the Patent Office, 23, Southampton Buildings, London, W.C.2.

1936

28764. "Frequency changers for heterodyne receivers and modulators." L. L. De Kramolin. October 24th, 1935. (Addition to 409756.) (489486.)

28826. "Mercury-vapour lamps." O. Gobel, and H. Riegelhaupt. October 23rd, 1935. (Cognate application, 28827/36.) (489361.)

28849. "Cathode-ray tube arrangement." Radio Akt.-Ges. D. S. Loewe. October 25th, 1935. (Cognate application, 28850/36.) (489362.)

32435. "Television signal receiving arrangements." British Thomson-Houston Co., Ltd. November 26th, 1935. (489426.)

35177. "Radio receivers." Murphy Radio, Ltd., L. A. Moxon, and J. D. A. Boyd. December 22nd, 1936. (489370.)

35357. "Electron mirrors." F. H. Nicoll. December 24th, 1936. (489428.)

35541. "Telephone receivers." E. Hausdorf. April 27th, 1936. (489540.)

1937

2165. "Electromagnetic apparatus for controlling beams of light." W. W. Groves. (I. G. Farbenindustrie Akt.-Ges.) January 25th, 1937. (489543.)

2208. "Electrical communication systems." Standard Telephones and Cables, Ltd., E. P. G. Wright, and C. B. V. Neilson. January 25th, 1937. (489545.)

2329. "Electron-discharge devices." Marconi's Wireless Telegraph Co., Ltd., and A. J. Young. January 26th, 1937. (489440.)

2370. "Electrolytic condensers of the dry or semi-dry type." Dubilier Condenser Co. (1925), Ltd. January 27th, 1936. (489498.)

2538. "Sealing of electric conductors through quartz envelopes." General Electric Co., Ltd., V. J. Francis, N. L. Harris, J. W. Ryde, and K. G. Schnetzler.. January 28th, 1937. (Cognate application 13553/37. (489630.)

2574. "Electrical condensers." Dubilier Condenser Co. (1925), Ltd. (W. Dubilier.) January 28th, 1937. (489560.)

2620. "Electric radiators." W. M. Betts. January 29th, 1937. (489633.)

2666. "Periodic voltage generator." Hazeltine Corporation. February 15th, 1936. (489625.)

2695. "Electric motor controllers." British Thomson-Houston Co., Ltd., and S. N. Bourne. January 29th, 1937. (489565.)

2725. "Automatic tuning apparatus for wireless receivers." J. Robinson. January 29th, 1937. (489571.)

2727. "Electric cables." Standard Telephones and Cables, Ltd. (Standard Telefon og Kabelfabrik Aktieselskab.) January 29th, 1937. (489572.)

2728. "Carrier-wave transmission systems." Standard Telephones and Cables, Ltd. March 26th, 1936. (489636.)

2981. "Electric smoothing circuit arrangements." Marconi's Wireless Telegraph Co., Ltd. January 31st, 1936. (489505.)

3069. "Electric torches." General Electric Co., Ltd., and S. W. Richards. February 2nd, 1937. (489382.)

3071. "Insulating material for electrical apparatus." British Thomson-Houston Co., Ltd. February 3rd, 1936. (489506.)

3589. "End coupling devices for electric cables." Liverpool Electric Cable Co., Ltd., J. T. Frost, and R. F. D. Milner. February 6th, 1937. (489510.)

5823. "Coin-actuated mechanism for electricity and similar meters." Aron Electricity Meter, Ltd., and E. J. Riordan. February 26th, 1937. (489394.)

5899. "Telegraph keyboard mechanism." R. G. Griffith. February 26th, 1937. (489513.)

6003. "Means for securing an electric lamp to a holder." D. H. Robbins. March 1st, 1937. (489515.)

9263. "Transformers for speech currents." General Electric Co., Ltd., and F. Clark. April 1st, 1937. (489451.)

17614. "Sheathed electric resistances." British Thomson-Houston Co., Ltd. June 24th, 1936. (489526.)

17939. "Overhead trolley wire systems." L. C. Spencer. June 26th, 1936, (489407.)

21186. "Sound-translating devices." Standard Telephones and Cables, Ltd. September 2nd, 1936. (489588.)

25799. "Electrical connectors or contact-making and breaking devices." H. D. Wight, W. Speers and Sunderland Forge & Engineering Co., Ltd. September 23rd, 1937. (489466.)

26762. "Electrically heatable spectacle lenses." C. Zeiss (firm of). October 5th, 1936. (489530.)

27379. "Station selection in a telegraphic communication system." Creed & Co., Ltd. December 24th, 1936. (489531.)

30398. "Electric inductors adapted to operate at high frequencies." Siemens & Halske Akt.-Ges. November 5th, 1936. (Cognate application 30446/37.) (489590.)

30719. "Combinations of electric-discharge lamps and electric incandescent lamps." General Electric Co., Ltd. April 26th, 1937. (Cognate application 30720/37.) (489591.)

31366. "Electric cooking and frying apparatus." E. Kolouch. November 15th, 1937. (489471.)

32934/5. "Sealing of electric conductors through quartz envelopes." General Electric Co., Ltd., V. J. Francis, N. L. Harris, J. W. Ryde and K. G. Schnetzler. January 28th, 1937. (Divided out of 489630.) (489626/534.)

33848. "Perforated-strip telegraph transmitters." Siemens & Halske Akt.-Ges. December 7th, 1936. (489597.)

35297. "Electric ironing-machines." British Thomson-Houston Co., Ltd. December 19th, 1936. (489474.)

36154. "Resonant electrical lines." Marconi's Wireless Telegraph Co., Ltd. January 4th, 1937. (489598.)

1938

296. "Apparatus for the topping up of electrical batteries with distilled water." R. E. Whiteley. January 5th, 1938. (489600.)

1487. "Electrical contact terminals and their method of manufacture." United-Carr Fastener Corporation. January 22nd, 1937. (489476.)

2906. "X-ray tubes." British Thomson-Houston Co., Ltd. January 30th, 1937. (489477.)

7865. "Process for uniting the bulb to the base in metal bulb electric discharge tubes." Egyesult Izzolampa Es Villamossagi R.T. March 13th, 1937. (489480.)

13769. "Television tube." Radio Akt.-Ges. D. S. Loewe. November 22nd, 1935. (Divided out of 31821/36.) (489422.)

13963. "Thermionic valves and thermionic valve circuit arrangements for use on short waves." Telefunken Ges. für Drahtlose Telegraphie. November 30th, 1935. Divided out of 488094.) (489608.)

18803. "Electrical communication exchange systems." Standard Telephones & Cables, Ltd., E. P. G. Wright and C. B. V. Neilson. January 25th, 1937. (Divided out of 489545.) (489609.)

Trade Mark Applications

THE following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from August 17th:—

Pye, Electric Age (lettering and design). No. 584136. Class 6. Vacuum cleaning machines, ventilating fans, refrigerating machines, &c., all being electrically operated.—Pye, Ltd., Radio Works, Cambridge.

Aerovac. No. 586382. Class 6. Vacuum cleaning machines. —John Barker & Co., Ltd., Kensington High Street, W.8.

Aroloy. No. 583775. Class 8. Scientific instruments and parts thereof. No. 583776. Metal goods included in Class 13.—The British Thomson-Houston Co., Ltd., Crown House, Aldwych, W.C.2.

Mobrey. No. 586158. Class 8. Apparatus for operating automatically switches, bells, lamps, motors and the like devices.—Ronald Trist & Co., Ltd., 1-3, Brixton Road, S.W.9.

Aim (lettering and design). No. 586336. Class 8. Instruments and apparatus for use in wireless telegraphy, telephony and television, and parts thereof.—Harry Paul Taylor, Radio House, 24, Rockington Road, Kettering.

Marchal. No 577707. Class 13. Electric head lamps for use in vehicles.—Pierre Marchal, 3, Rue Delabordere, Neuilly-sur-Seine, France (British representatives, Abel & Imray, 30, Southampton Buildings, Chancery Lane, W.C.2).

Mutac. No. 586003. Class 13. Electric lamps (ordinary).—The General Electric Co., Ltd., Magnet House, Kingsway, W.C.2.

Coslok. No. 586353. Class 13. Electric connecting or disconnecting links, electric contacts, fusible cut-outs, and electric fuse carriers.—G. P. Cosway, Ltd., 2, Princes Street, Coton Road, Nuneaton.

Amplion. No. 586629. Class 13. Electric lamps (ordinary). —Amplion (1932), Ltd., 146, Theobalds Road, W.C.1.

Progress in the S.W. Midlands

THE South-West Midlands Advisory Joint Committee's annual report of the Birmingham Corporation and the S.W. & S. Electric Power Co., states that the concentration of generation at Hams Hall and Nechells has led to the closing down of the Summer Lane station and Nechells temporary station. At Hams Hall a 50,000-kW turbo-alternator and two 250,000 lb.-per-hr. boilers have been brought into operation, thus raising the effective capacity of the station to 240,000 kW. The closing of Nechells temporary station has, incidentally, brought about the cessation of the 25-cycle supply in Birmingham. Further extensions, consisting of a high-pressure boiler for the Hams Hall "A" station and a 50,000-kW turbo-alternator with three high-pressure boilers and one cooling tower for the "B" station, have been authorised, while at Stourport (S.W. & S. Co.) new plant comprises two 30,000-kW turbo-alternators and three 160,000 lb.-per-hr. boilers, and further extensions authorised (one 30,000-kW set and two h.p. boilers) will bring the capacity of the plant up to 176,000 kW. There is shortly to be put in operation a new double-circuit 66-kV overhead line from Stourport to Oldbury and 33-kV underground cables between Oldbury and Smethwick. Extensions have brought the total number of transformer centres in this area to 147. In the S.W. Midlands District apparatus connected to the mains showed an advance of 17.6 per cent., while the increase in the number of consumers was 42,061 (44,689 in 1936-7). Electricity sold at 572 kWh (520 kWh) per head totalled 1,018,766,886 kWh (923,853,228 kWh). The fuel consumption was 1,064,709 tons (946,508), equivalent to 1.6638 lb. (1.7391 lb.) per kWh generated.

New Work for Contractors

Particulars of new works and building schemes for the use of electrical installation contractors and traders

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Aberdeen.—Cinema, Union Street, for Associated British Cinemas; the secretary.

Barnsley.—Extensions to premises; Barnsley British Co-operative Society, Ltd., Wellington Street.

Beaconsfield.—Houses (26), Fernhurst, for U.D.C.; Building and Public Works Construction Co., Ltd., Swindon.

Beckenham.—Library (£12,458); borough engineer.

Bedwellty.—Houses (118), Blackwood estate; U.D.C. surveyor.

Berkhampstead.—Baths; U.D.C. surveyor.

Birkenhead.—Houses (27), Highfield estate; H. W. Lloyd, Ltd.

Birmingham.—Children's Home, Weolay Park Road; G. Webb & Sons, Ltd., contractors, Soho Hill.

Birtley.—Houses (12), Orchard Street; A. H. Hanson.

Bishop Auckland.—Extensions to premises of Marks and Spencers, Ltd.; Bovis, Ltd., builders, 82, South Audley Street, London, W.1.

Blackburn.—New dairy for Co-operative Wholesale Society, Ltd., Balloon Street, Manchester.

Blackpool.—Two private hotels at Star Gate, South Shore (£10,000); W. Emery & Son, builders, Squires Gate, South Shore, Blackpool.

Blyth.—Schools, Bebside and Gordon Road; borough engineer.

Bournemouth.—Shops and houses, Muscliffe Farm estate; A. J. Abbott & Son.

Cardiff.—Showrooms and garage in Wood Street; Messrs. Merrett & Stephens, Ltd.

Coalville.—Extensions to factory, for Cascelloid, Ltd.

Cockermouth.—Houses (50), Windmill Lane site, for the U.D.C.; H. Oldfield, architect, Workington.

Colne Valley.—Houses (26), Marsden and Golcar, for U.D.C.; Lunn, Heppenstall & Lunn, architects, Milnsbridge, Huddersfield.

Coventry.—Erection of 40 houses, Guard House Road, for C. A. Huckson, Treherne Road. Houses (54), Black Watch Road, for E. Batley, Cap Martin Road. Houses (500), Canley estate, for the T.C.; W. J. Simms, Son & Cooke, Ltd., contractors, Haydn Road, Sherwood, Nottingham. Houses (188), Black Watch Road, Outermarch Road, Middlemarch Road and Telper Road, for Breeze and Burdett, 4, Stevenson Road, Keresley. Houses (68), Hermit's Croft, St. Christian's Croft, John Grace Street and St. Christian's Road, for A. E. Gilks, Lythalls Lane. Houses (46), Poiters Road and Mary Herbert Street, for A. Jervis, Holyhead Road. Houses (35), Abbey Road and Ashington Grove, for James and Edwards, 141, Spon Street. Church halls at Stoke, Aldermoor, Wyken and Stivichall (£10,000); Geo. Cooper & Son, builders, Midland Road, Nuneaton.

Cowbridge.—Houses (14), Llanharry; E. Loveluck, architect, 12, Dunraven Place, Bridgend.

Darlington.—Laboratory and offices, Neasham Road, for Simpson and Co.; J. Clayton, architect, High Row Chambers. Extensions to Beaumont Street Council school for the E.C. (£4,000); W. Sanders Hutton, Ltd., builders, Post House Wynd. Additions to the Guerney Pease School, for the E.C.; borough engineer. Rebuilding locomotive sheds for the L.N.E.R.; Haymills (Contractors), Ltd., Hanger Green, London, W.5.

Dartford.—Factory, for Jos. Wells & Sons, Honor Oak Park, London, S.E.

Denbighshire.—School, Mochdre, near Colwyn Bay, for the County E.C.

Dorset.—Technical institute, Newstead Road, Weymouth, for the County E.C.

Dudley.—Houses (53), Selbourne Road, for Percy Cox, Park Road, Quarry Bank, Brierley Hill.

Durham.—Schools; county architect.

Epping.—Houses (46), Roydon & Sheering, for R.D.C.; Algar & Co., builders, Romford.

Ferrybridge.—Factory, for Robinson & Wordsworth, Ltd.; Pennington, Hustler and Taylor, architects, Ropergate, Pontefract.

Fleetwood.—Extensions to Blakiston Council Schools (£18,275); county architect, County Offices, Preston.

Gateshead-on-Tyne.—Warehouse, &c., for Messrs. Ringtons, tea dealers, Newcastle; W. W. Kelsey, Back Hanover Square, Newcastle. Factory extensions, Kingsway; North Eastern Trading Estates, Ltd.

Glasgow.—Houses (162), Holmfauldheda; housing director, City Chambers, George Square.

Grimsby.—Library extensions (£30,000); borough engineer.

Harleston (NORFOLK)—School; Church of England authorities.

Hastings.—Development of St. Helen's Close estate; F. A. Woor.

Hebburn-on-Tyne.—Library, Station Road; J. M. Black, Ltd., builders, 3, Grange Road, Jarrow-on-Tyne.

Herefordshire.—School, Leintwardine, for the County E.C. School, Manland Common, Harpenden, for the County E.C.

Huyton.—Houses (164), Mill Estate, Roby; Paramount Estates, Ltd.

Jarrow-on-Tyne.—Extensions to Tube Works; R. Smith, managing engineer, Jarrow Tube Works.

Johnstone.—Houses (200), for Scottish Special Areas Housing Association, Ltd.; S. Bunton, architect, 235, Bath Street, Glasgow.

Kidderminster.—Extensions to Institution (£15,000); Worcestershire County Council.

Lancashire.—Senior Department, Burtonwood Council school (£11,980); Stephen Wilkinson, county architect, County Offices, Preston.

Lanchester.—Isolation Hospital, Ormsby Hill; Joint Hospital Board.

Leyton.—Branch library and shops, High Road, Leytonstone (£35,530), for T.C.; Raglan Building Co., Ltd., Forty Lane, Wembley.

Litherland.—Council offices and Town Hall; G. de C. Fraser, architect, Dale Street, Liverpool.

Littlehampton.—School and health centre (£51,170); R. Cook & Sons, Ltd. Enlargement of Connaught Road school (£13,498); Patching & Co.

Liverpool.—Flats (154), St. Domingo Road site; director of housing, Blackburn Chambers, Dale Street.

London.—(CLAPTON).—Factory, Theydon Road; Commercial Structures, Ltd., contractors, Staffa works, Staffa Road, E.10.

Margate.—Civic centre, Hartsdown; borough surveyor.

Morley.—Cinema, Queen Street; London and Southern Super Cinemas, Ltd.

Nelson (LANCS).—Swimming pool; borough engineer.

Newcastle-on-Tyne.—Houses (50), Gillies Street; G. R. Holmes, architect, 1, Prior Terrace, Tynemouth. Large stores, Northumberland Street; Bainbridge and Dann, solicitors, Central Exchange Buildings.

Northfleet.—Houses (76), Perry Street; U.D.C. surveyor.

Nottingham.—Houses (68), Westdale Lane, Gedling; H. Norman Dukes, 19, Victoria Street, Nottingham.

Nuneaton.—Baths; borough engineer.

Orpington.—Factory, St. Mary Cray; Barry & Coote.

Pudsey.—Houses (60), Roker Lane estate; borough engineer.

Reigate.—Houses (50), Wood Street; borough engineer.

Retford.—Fire station (£12,500); borough engineer.

Risca.—Houses (74), Cwmynant estate; U.D.C. surveyor.

Rothwell.—Additions to Council Offices; N. A. Paxton, architect. 34, Prudential Buildings, Park Row, Leeds.

Runcorn.—Houses (40), Weston Road; R. Russell, Taylor & Son.

Salford.—Houses (50), Council estates; city engineer.

Saltcoats.—Houses (53), with electrical work, for T.C.; H. Thomson & Sons, architects, 60, Hamilton Street.

Scarborough.—Houses (24), for R.D.C.; **Jaram** & Son, builders, Gladstone Road.

Shadforth.—Houses (14), Cuthberts Road; clerk to the R.D.C., 40, Sadler Street, Durham.

Sheffield.—Houses (200), Mansfield Road, etc.; A. E. Clayton. Houses (60), near Norton Avenue; Smith, Denton & Co.

Shropshire.—School, Dawley, for County E.C.

Staines.—Factory, London Road; W. C. Taylor. Houses (42), Worple Road; R. T. Jubb.

Stokesley.—Houses (28), Ormesby; Mr. Pilkington.

Stratford-on-Avon.—Houses; R.D.C. surveyor.

Suffolk.—School, Felixstowe; county architect, 9, Burlington Road, Ipswich.

Sunderland.—Shops, Plains Farm estate; borough engineer.

Swansea.—Houses (614) and school, Cwn area; borough architect. Grammar school (£111,898); borough architect.

Torquay.—Extensions to pavilion (£20,245); T. Vanstone & Sons. Extensions to fire station; borough engineer.

Tynemouth.—Hotel, Promenade; J. R. Wallace, architect, 20, Northumberland Square, North Shields.

Walsall.—Block of shops and flats, Ryecroft housing site; borough engineer, The Council House.

Washington.—Cinema, for Southgate Cinemas, Ltd.; K. F. Greene, contractor, Campo Lane, Sheffield.

Weymouth.—Houses (16), Chapel Lane; borough engineer, Upway. Houses (12), Hardy's Avenue; J. Hardy. Houses (13), Marlborough Avenue; Andrews & Andrews. Shops and offices, Market House site, St. Mary Street; Collins & Geens.

Widnes.—Houses (43), Alfred Street and Brynn Street, for J. Allister, Pen-lan, Barlows Lane, Walton.

Willington.—Houses (26), Sunnybrow; North Eastern Housing Association, Ltd.

Windsor.—Cinema, Stoke Poges Road; H. Weston, architect, 81, Chester Square, London, W.1.

Wisbech.—Houses (52); R.D.C. surveyor.

Worthing.—Police premises (£18,342); West Sussex county architect. Shops and flats, Grafton House site, Marine Parade; F. C. Mitchell, architect.

Bolts for Transmission Line Supports

FOLLOWING tests made to Swiss requirements on a number of materials, including aluminium-bronze, to discover which behaves most satisfactorily as bolts to support transmission lines, the nickel-copper alloy "Monel" has been specified throughout the Etselwerk and Winkeln sub-stations. A point of interest in this connection is the fact that ozone in the vicinity of high-voltage wires is apt to set up corrosive conditions which Monel metal is said to resist. Its strength and ductility make it a suitable material even under conditions of temperature fluctuation which in Switzerland covers a considerable range during the year. The Etselwerk station has a capacity of 144,000 h.p. and supplies energy for industrial purposes and partly for railway traction. This station consists of three transformers and four transmission lines operating at 150 kV, three transformers for railway supply at 66/16 kV, eight transmission lines at 66 kV, and eight lines at 16 kV.